AUGUST

THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

Calculus of Submaxillary Gland—*Berger & Berke*
Therapy for Pulpless Teeth—*Walker*
Orthodontic Patient—*Noyes*
Retention of Artificial Dentures—*MacMillan*
Diet Factor in Healing—*Molt*
Cardiac Patient—*Boyne*
Civilization—a Disease—*Brekhus & Armstrong*
Appliance Construction—*Humphrey*
Vincent's Infection—*Nesson*
Lactobacillus Acidophilus—*Johnston et al.*
Denture Base Material—*Sweeney & Schoonover*
Syphilis—*O'Leary*
Partial Dentures—*Neurohr*

EDITORIAL
Arraignment of Mothers

COUNCIL ON DENTAL THERAPEUTICS
Annual Meeting

BUREAU OF PUBLIC RELATIONS
Economic Value of Health Education—*Fixott*

DENTAL ECONOMICS
Economics Committee
—*Morrey*

CONTENTS

Ralph R. Byrnes, D.D.S., F.A.C.D. ..... Frontispiece

ORIGINAL COMMUNICATIONS

Calculus of the Submaxillary Gland.
By Adolph Berger, D.D.S., F.A.C.D., and Joseph D. Berke, D.D.S. 1397
A Definite and Dependable Therapy for Pulpless Teeth.
By Alfred Walker, D.D.S. 1418
The Medical Background of the Orthodontic Patient.
By Harold J. Noyes, B.S., D.D.S., M.D. 1426
Anatomy of the Throat, Mylohyoid Region and Mandible in Relation to Retention of Mandibular Artificial Dentures.
By Hugh W. MacMillan, D.D.S., M.D., F.A.C.D. 1435
Diet as a Factor in Healing.
By Frederick F. Molt, D.D.S. 1442
Taking of Registrations for Securing Centric Jaw Relation.
By Finis Marlin Hight, D.D.S., F.A.C.D. 1447
The Dentist's Responsibility to the Cardiac Patient.
By H. N. Boyne, M.D., D.D.S., M.S. 1451
Civilization—a Disease.
By P. J. Brekhus, B.A., D.D.S., F.A.C.D., and W. D. Armstrong, Ph.D. 1459
Technic of Orthodontic Appliance Construction Using Chrome Alloy Metals.
By William R. Humphrey, D.D.S. 1471
Surgical Technic for Removal of Impacted and Hypercementosed Teeth.
By James A. Blue, D.D.S., F.A.C.D. 1480
Diagnosis and Treatment of Vincent's Infection.
By John H. Nesson, D.M.D. 1483
Lactobacillus Acidophilus in Dental Caries.
By Marion M. Johnston, C. H. M. Williams, P. G. Anderson, T. G. H. Drake, F. F. Tisdall and Mildred J. Kaake 1493
A Progress Report on Denture Base Material (1935).
By W. T. Sweeney, A.B., and Irl C. Schoonover, Ph.D. 1498
Williams' Classification of Anterior Tooth Forms.
By M. Russell Stein, D.D.S. 1512
Lesions of the Mouth from Sensitization to Base Plate Material.
By Herbert Rattner, M.D. 1519
Significance of Syphilis to the Dentist.
By Paul A. O'Leary, M.D. 1523
Spring Lock and Insertion Pin Lock Attachments in Saddle Designs for Partial Dentures.
By Ferdinand G. Neurohr, D.D.S. 1530
A Consideration of Heart Disease and Syncope in the Practice of Dentistry.
By Joseph A. Capps, M.D. 1543
A Clear Instance of Repair of a Fractured Root: Report of Case.
By Esther E. Svoboda, D.D.S., and F. J. Svoboda, D.D.S. 1546

EDITORIAL DEPARTMENT

An Arraignment of Mothers.—The Government and the Citizen. 1547-1550

Practice in Paragraphs 1551

COUNCIL ON DENTAL THERAPEUTICS

Annual Meeting of the Council on Dental Therapeutics 1553

BUREAU OF PUBLIC RELATIONS

Economic Value of Dental Health Education in Public Schools.
By Henry Cline Fixott, D.M.D., F.A.C.D. 1567
Dental Record of Corsicana, Texas, Orphanage 1576

DENTAL ECONOMICS

What the Economics Committee of the American Dental Association Is Doing.
By Lon W. Morrey, D.D.S. 1579
Phases of a Community Dental Credit Bureau.
By H. D. Meyer, D.D.S. 1588
"Resolutions Aren't Enough" 1591

CURRENT LITERATURE

Abstracts 1592

MISCELLANY

Book Review 1596
News 1597

Announcements 1598

LIBRARY BUREAU

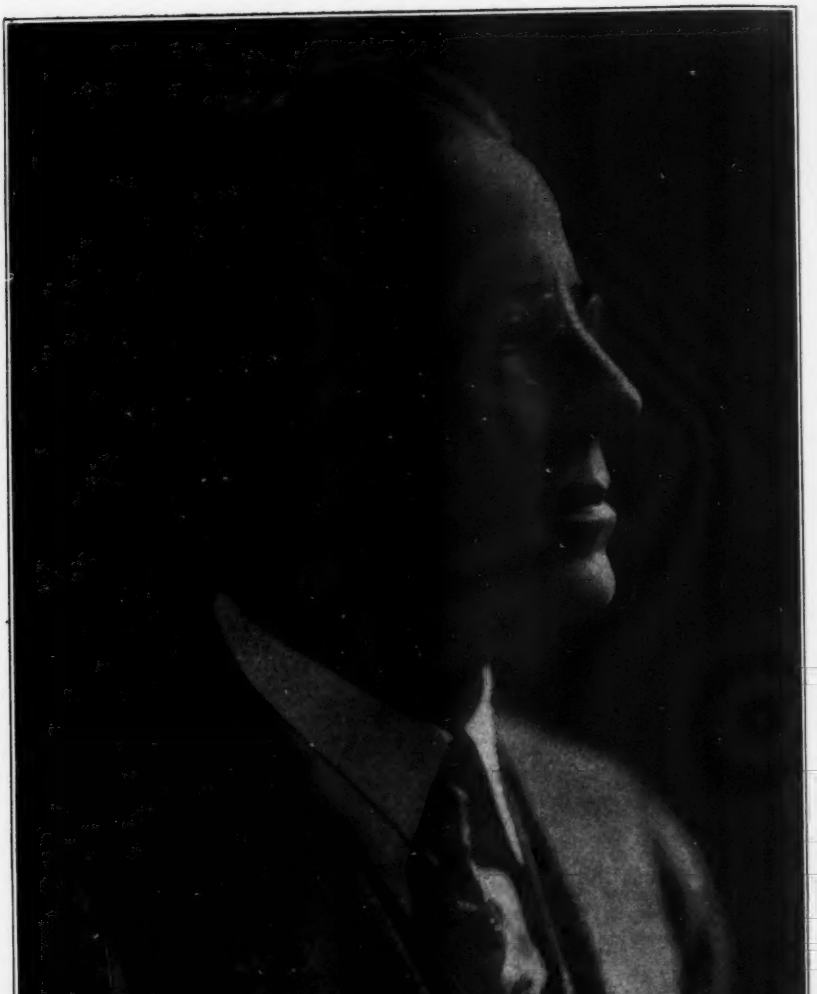
Package Libraries 1601

ADVERTISEMENTS

Index to Advertisements A-43
Classified Section A-32

The Journal of the American Dental Association. Vol. XXIII, No. 8. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Entered as second-class matter, May 1, 1928, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly.

Copyright, 1936, by the American Dental Association.



RALPH R. BYRNES, D.D.S., F.A.C.D., Atlanta, Ga.
President of the American Association of Dental Schools

THE JOURNAL
of the AMERICAN DENTAL ASSOCIATION

Vol. 23 AUGUST, 1936 No. 8

Original Communications

CALCULUS OF THE SUBMAXILLARY GLAND*

By ADOLPH BERGER, D.D.S., F.A.C.D.,
and JOSEPH D. BERKE, D.D.S., New York City

THIS report is based upon the clinical study of forty-five cases of salivary calculus in the submaxillary gland and the histologic examination of fourteen of the calculi removed.

ETIOLOGY OF SALIVARY CALCULUS

The foreign body theory was advanced by Mareau[1] (1876), by Czigan[2] (1890) and later by one of us (A. B.)[3] (1923). It has been suggested that a foreign body such as a fragment of tartar, fish bone and grain kernel may find its way into Wharton's duct and into the gland and thus form the basis for the deposition of calcific salts from the saliva. Schuh[4] (1913) advanced the opinion that a foreign body, by irritation, may cause inflammation of the duct or gland with alteration of the salivary secretion. Calcium salts are then laid down upon the foreign body.

Inflammatory Theory. — Immisch[5] (1861) stated that a chronic inflammation of the duct causes a slowing of the salivary flow. As a result, a precipitate forms in the lumen of the duct and the eventual incrustation forms a calcium tube. One tubular calculus was reported in the literature, by Choronohitzky.

Lang[6] (1929) noted that microscopic stones can be formed in general diseases, such as typhoid, sepsis and tuberculosis. He believes that these infectious diseases render the glands less resistant to the stone-forming parasites. He further suggests that, on stagnation, thickening

*From the Departments of Oral Surgery, School of Dental and Oral Surgery, Columbia University, and the Hospital for Joint Diseases.

1. Mareau: Thèse de Paris, Virchow's Arch., 1876.
2. Czigan: Diss. Konigsberg, 1890.
3. Berger, Adolph: Principles and Technique of Oral Surgery, Brooklyn Items of Interest Publishing Co., 1923, pp. 404-407.
4. Schuh: Diss. Heidelberg, 1913.
5. Immisch: Monographie d. Deutsch. Klin., 1861.
6. Lang: Handb. d. Spez. Pathol. Anat. u. Histol., 1929.

of the saliva occurs and, with the resorption of the watery material, calcium salts are precipitated. He refers to the known fact that cloudy calcium carbonate appears in saliva on standing; also that stagnation favors bacterial growth and that the precipitation of lime salts is the life function of some bacteria.

The Parasite Theory.—Maas[7] (1871) was the first to suggest that the stone formation might be due to bacteria. Klebs[8] (1876) advanced the theory that the deposits were caused by calcium-precipitating organisms. Bacteria do not,

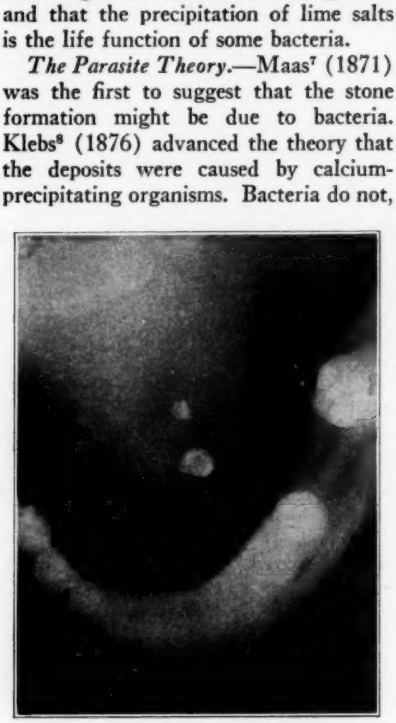


Fig. 1.—Two irregular calcific masses in floor of mouth that were found in different tissue planes.

as a rule, invade intact mucous membrane, and we must assume some flaw in this structure. Bensussan[9] (1933) points out that if the mouth flora alone were capable of causing the disease, all individuals would suffer from sialolithiasis.

In experience or in the reports published, we find no bilateral calculi although all salivary ducts are exposed to the same organisms. Furthermore, the parotid gland is more frequently infected than is the submaxillary gland; nevertheless, by comparison, the parotid gland is only rarely the seat of sialolithiasis.

Soderlund and Naslund[10] (1919, 1925, 1926) strongly adhere to the idea that grain kernels bearing actinomyces find their way into the duct and their pressure causes the primary irritation. According to Soderlund, the presence of these fungi, thus introduced, causes inflammatory changes and is directly responsible for sialolithiasis. He found such fungi consistently in the study of fifty cases.

Majocchi[11] (1910) found these fungi only in one of sixteen cases. Roedelius[12] (1917) studied sixteen cases, Risak[13] (1929) fourteen cases, and Bode[14] (1892) two cases, but they found no fungi.

New and Harper[15] (1931) state that saliva from the submaxillary glands contains a higher percentage of solids and organic matter and has a greater degree of alkalinity and a lower content of

7. Maas: "Die Schweninger Kur" Diatetische und entfettung, 1886.

8. Klebs: Arch. f. Exper. Pathol., Vols. 5 and 6, 1876.

9. Bensussan: Ueber die Speichelsteinkrankheit und ihre enstehung, Berlin: R. Pfau, 1933.

10. Soderlund: Sialolithiasis, Acta Chirg. Scand., 63:237, 1927.

11. Majocchi: La Chirurgia dell' apparato digerente all' estero, Milan: F. Vallard (reprinted, Clin. Chir.), 1910.

12. Roedelius: Beitr. z. Speichelsteinerkrankung, Deutsche Ztschr. f. Chir., 141:263, 1917.

13. Risak, E.: Deutsche Ztschr. f. Chir., pp. 206, 219, 1929.

14. Bode: Ueber Kropfexstirpation, Berlin. Klin., No. 44, 1892.

15. New, G. B., and Harper, F. R.: Surg., Gynec. & Obst., 53:456-460 (Oct.) 1931.

carbon dioxide than the saliva of the parotid or lingual glands. Tartar usually forms about the lingual surface of the lower anterior teeth, and it is probable that the same conditions produce the stones in the submaxillary glands and ducts.

Ivy and Curtis[16] (1932), in a report on seventy-two cases of sialolithiasis and infections of the salivary glands have made an exhaustive study of the clinical course and incidence of the affection, but offer no conclusions regarding the etiology.

tions of the gland may be only remotely exposed to direct oral contamination. In several cases, we found the calculus lodged at a point where the gland is not to be found normally.

The following cases strongly suggest the probability of this process:

A white woman, aged 30, complained of mild periodical discomfort in the floor of the mouth of about six months' duration. The tissues appeared to be normal and no suppuration was noted at any time. The roentgenogram (Fig. 1) disclosed two larger and one rather small calcific bodies.

Fig. 2.—Unusually large salivary calculus associated with submaxillary gland. As indicated, the stone was found at some distance from the normal location of the gland.

To the above-enumerated etiologic factors, we add a congenital or developmental possibility. It seems reasonable to assume that an aberrant or abnormal formation of the gland may lead to stagnation of the saliva, with a resultant inflammatory reaction, leading to the precipitation of calcium salts. Such portions of the gland may be only remotely exposed to direct oral contamination. In several cases, we found the calculus lodged at a point where the gland is not to be found normally.

The following cases strongly suggest the probability of this process:

A white woman, aged 30, complained of mild periodical discomfort in the floor of the mouth of about six months' duration. The tissues appeared to be normal and no suppuration was noted at any time. The roentgenogram (Fig. 1) disclosed two larger and one rather small calcific bodies. Wharton's duct, as a rule easily probed, could not be followed beyond about three quarters inch. The concretions were found as shown by the roentgenogram at different levels in the tissue planes. Figure 2 presents the roentgenograms of a man, aged 26. In this case, pus was discharged from Wharton's duct for about six months. There was also the characteristic recurrent swelling. The calculus was lodged as shown in the tissues of the pillars of the fauces outside the area of the gland proper.

16. Ivy, R. H., and Curtis, L.: Ann. Surg., 96:979 (Dec.) 1932.

SYMPTOMS AND SIGNS

The disturbing symptoms may be acute, subacute or chronic. Acute symptoms are usually sudden in their onset, but are sometimes preceded by minor disturbances. The symptoms may be the same when the calculus is lodged in the duct as when in the gland. There is a diffuse inflammatory infiltration or edema of the submaxillary and sublingual areas, but excessive inflammation occurs only in few cases. The acute state is always attended by suppuration, although discharge of pus from Wharton's duct is not always present. In some cases, pus could be demonstrated only when an incision was made for drainage.

The development or the degree and extent of the acute symptoms are not determined by the size of the stone. The first acute symptoms may arise when the calculus is no larger than a kernel of rice; while, in other cases, the stone may be of considerable bulk when acute symptoms developed. Nor is its location the determinant in this respect. Stones only a few millimeters long lodged in the duct

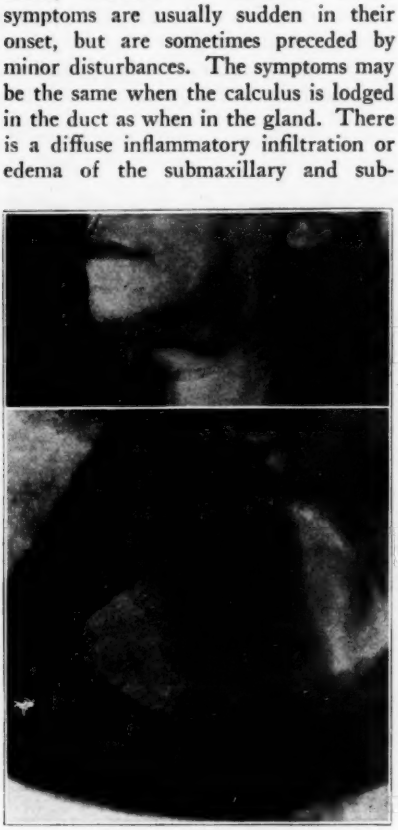


Fig. 3.—Above: Enlargement of salivary gland caused by presence of salivary calculus shown below. The photograph was taken after a cracker was eaten, mastication causing an increased flow and retention of the saliva. The overlying tissues are characteristically uninvolved. Below: Calculus erroneously located through angulation of roentgen rays.

Fig. 4.—Above: Indurated ridge in floor of mouth, condition being caused by presence of salivary calculus in Wharton's duct, as shown below. A photograph of the calculus is shown in Figure 8, 5. Below: Salivary calculus in Wharton's duct. The variation in its radiolucency is evident.

or in the gland have caused marked symptoms. Individual susceptibility to inflammatory reactions may be a factor. The type of organisms and the relationship of the involved tissues should be also considered.

The subacute state is most commonly met clinically and is not always preceded by acute symptoms. It is marked, in most cases, by pus discharge from Wharton's duct, although, in several instances, we noted no suppuration. The stone may be lodged in the duct or in the gland. The chief disturbing symptom is the periodical enlargement of the gland.

This is well illustrated in the following case:

Mrs. A. G. (Fig. 3, above), aged 42, complained of discomfort caused by a swelling in the submaxillary area for the past eight to ten years, which always increased on eating. No definite diagnosis was reached in numerous consultations. The only disturbing sign was the swelling. There was no actual pain and the comparatively mild discomfort would soon disappear. The salivary gland was markedly palpable, but was not acutely inflamed. Dental roentgenograms were negative. In lateral jaw plates, the calculus was indiscernible, as its shadow blended with the osseous structure. The

Fig. 5.—Left: Patient in whom salivary calculus escaped detection because only dental roentgenograms were taken. The clinical picture was obscured by repeated incisions, as shown in the photograph. Right: Calculi as shown on lateral plate.

This is caused by the increased secretion of saliva brought on by psychic, olfactory or gustatory stimulation. The swelling affects the gland alone, and the distention causes some degree of discomfort, but little real pain.

Suppuration is a negligible factor in causation of the symptoms. When secretion declines, the saliva gradually escapes, turgescence is relieved and the patient is again comfortable.

history pointed unmistakably to a retarded flow of saliva and the outstanding symptoms were pathognomonic of salivary calculus. On careful bimanual palpation, a rounded hard body was detected at the base of the tongue beyond the normal location of the submaxillary gland. A lateral roentgenogram was taken through the opposite side of the mandible. (Fig. 3, below.) This revealed the calculus, which, through the angulation of the rays, was projected into a deceptive position.

Under local anesthesia, the calculus was found deeply imbedded at the base of the tongue in the tissues just anterior to and beneath the pillars of the fauces.

It is reasonable to assume that, after a time, degenerative changes occur in the stroma and also in the parenchyma of the gland. Clinical observations suggest that the changes are not essentially destructive as the gland continues to function and, with the removal of the stone, it is, after a lapse of time, no more palpable than under normal conditions.

grows large enough, the patient becomes conscious of it in the duct and notes its presence as a foreign body. One patient of 65 years harbored a calculus for over sixteen years before he sought treatment. Because of its size, it caused a marked bulge and irritated the tongue.

DIAGNOSIS

In the diagnosis, it is essential to differentiate between a calculus in the duct and one in the gland. A calculus is often propelled from the gland into the duct

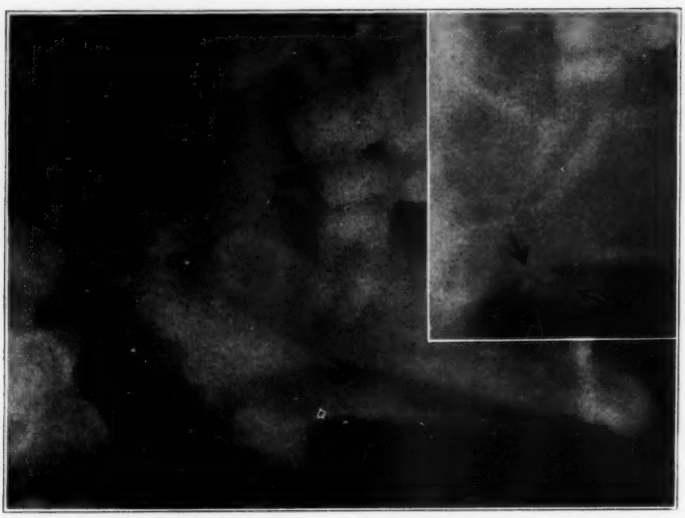


Fig. 6.—Left: Multiple calculus at base of Wharton's duct. The calculus was only partly removed and the symptoms persisted. Right: Part of calculus left in place, which was removed subsequently.

Chronicity occurs more frequently when the calculus is lodged in the duct than when it is in the gland. This stage is characterized by persistent suppuration of variable amount and occasional slight disturbances. The pus is usually inoffensive and flocculent, owing these characteristics probably to a constant dilution by the saliva. When a calculus and is sometimes completely expelled. The stone may also escape through a fistulous opening when active suppuration is present.

The calculus can almost always be demonstrated when clinical signs and symptoms arise. The external form of the stones is determined by the site in which they develop. Multiple stones may

occur at any point of their formation. The calculi that form in the duct are usually cylindrical or oblong. Those found in the gland are irregular or spherical and their surface may be smooth or spiny and rough. (Fig. 8.) They tend to dam up the saliva and may also act as physical irritants. Some are propelled from deeper parts into the inflamed, narrowed lumen of the duct, where they act as would an incomplete stopper. Suppuration may, or may not, be present. As pointed out before, suppuration does not always cause acute symptoms.

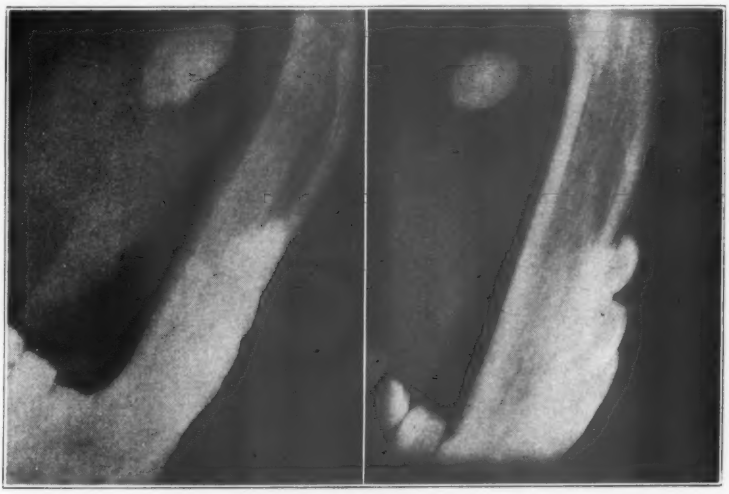


Fig. 7.—Left: Large irregularly outlined calculus lodged in substance of gland. Right: New calculus formed at same point (roentgenogram taken about fifteen months after first calculus shown at left was removed).

Inspection.—Chronic or recurrent discharge of pus from Wharton's duct is almost always pathognomonic of salivary calculus. The bulk of a larger stone may be observed by inspection. The surrounding tissues not infrequently form an indurated ridge. (Fig. 4.)

Palpation.—A normal submaxillary salivary gland is scarcely palpable except in very thin or emaciated people. On irritation caused by the presence of a calculus, the gland becomes appreciably enlarged from the inflammation and the engorgement with saliva. The distended gland is tender on deep palpation, but is not acutely painful. The overlying skin and integument glide freely over the gland. (Fig. 3, above.) The surrounding tissues become involved only when the pus breaks through, which is rare.

Digital palpation with the forefingers in the floor of the mouth and underneath the mandible is of value whether the stone is lodged in the deeper part of the duct or in the gland. Palpation is helpful especially when the roentgenogram does not disclose the calculus clearly because of the superimposed structures; when the position of the stone prevents including it in an intra-oral bite film,

or when it is of poor consistency, and casts only an ill-defined or indiscernible shadow.

Probing Wharton's duct will often determine the presence of the foreign body. This should be done with discretion so that the wall of the duct is not penetrated and the calculus is not pushed into the deeper parts. When the stone is lodged in the gland, probing is of little or no avail.

or posterior to the base of the tongue, lateral plates should be taken with such angulation that the mandible and other osseous structures do not obscure the calculus. A calculus lodged in Wharton's duct can be best demonstrated by making the exposure through the floor of the mouth, the rays being directed parallel with the long axis of the lower teeth. (Fig. 4, below; Fig. 7.)

Faulty diagnosis because of dependence

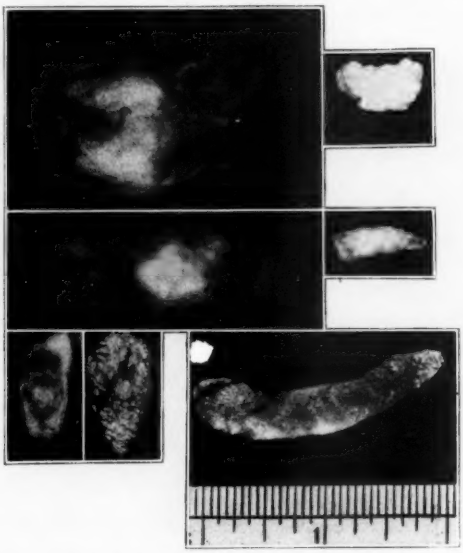


Fig. 8.—Roentgenograms and photographs of salivary stones 1 (above, right and left), 5 below, left and center), 6 (center, left and right) and X (below, right). The variation in size and shape is evident. The photographs are of actual size. Roentgenograms of stones 1 and 6 have been enlarged. A comparatively opaque focus is visible in all of them. Stone X is an unusually long specimen removed from Wharton's duct.

Palpation and probing are aids not only in the diagnosis but also in localization of the calculus during its removal.

Roentgenography.—In seeking a salivary calculus, the customary dental roentgenograms are of little or no aid. When the stone is located in the gland on intra-oral films is demonstrated by the following case:

A man, aged 28, white, in good physical condition, had been suffering for over three years from a recurrent swelling in the right submaxillary area which started abruptly as an acute condition. Extra-oral incisions were made to evacuate the pus and the con-

dition was ameliorated during the intervening periods. (Fig. 5.) The dental films showed no dental abnormality to account for the infection. Four operations were performed for drainage. Radium treatment was advised next, although the history definitely indicated that the lesion was inflammatory. Lateral roentgenographic plates showed the presence of two or more salivary calculi of considerable size. (Fig. 5, below.) Prompt recovery followed their removal.

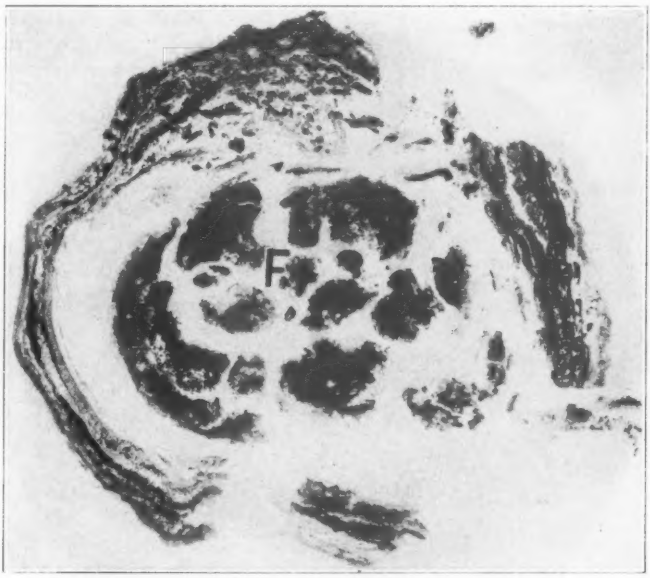


Fig. 9.—Ground section of calculus 1 (Fig. 8). A dense laminated peripheral ring surrounds the inner masses. *F*, focus in center of structure. (24 mm. lens; ×35.)

With pulpless teeth in the area, the condition can be and frequently is mistaken for a dental abscess, and suspected teeth are unnecessarily removed. The absence of continuity between the area of swelling and the periosteum of the bone is an important clinical sign in differential diagnosis.

The history of recurrent swelling should exclude the likelihood of a neoplasm. The swollen gland should be further differentiated from enlarged lymphatic nodes. The latter occur usually as smooth egg or almond shaped bodies and are more constantly enlarged. The enlarged salivary gland feels somewhat spongy and lobulated on palpation and varies in size.

TREATMENT

The complete removal of the gland has been advised by other authors when the stone has formed in the gland; when there is suppuration present, and when the gland has undergone parenchymatous and interstitial fibrous degeneration because of prolonged inflammation or suppuration.

In all cases in this series, the calculus alone was removed. The glands were

left *in situ* and permanent cure was effected. We are not alone in the view that the gland should be removed only in rare cases.

In our experience, all suppuration ceased on the removal of the calculus, and whether removal was from the duct or from the gland, there was no recurrence. A new calculus formed in one case. (Fig. 7.)

after the calculus has existed for some time. Furthermore, the degree of degeneration cannot be determined without a pathologic examination. The outstanding sign, the distention of the gland, due to retention of saliva, is pathognomonic, and should indicate that although pathologic changes may have occurred, the secretory function of the gland is not destroyed.

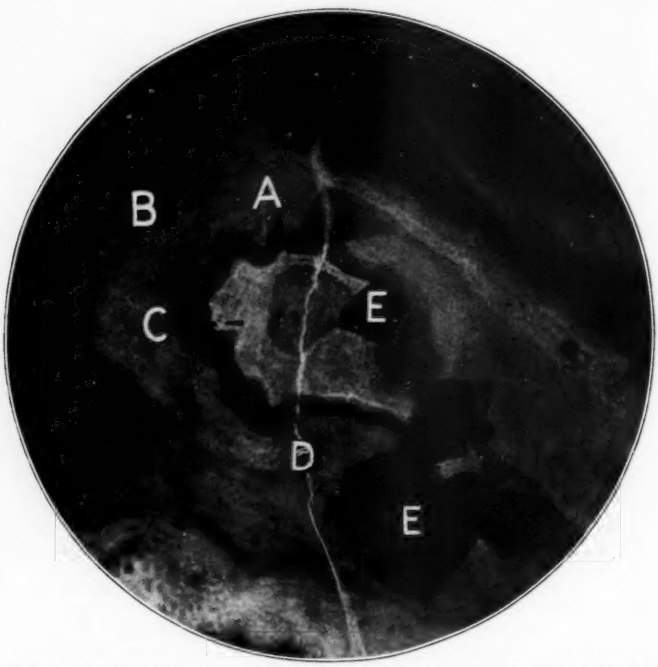


Fig. 10.—High power photomicrograph of calculus 3, showing giant cell in basic substance. The "lacuna" is limited by a ring of deeply stained basic substance. *A*, giant cell; *B*, basic substance; *C*, lacuna; *D*, tear in specimen; *E*, artefact. (Hematoxylin and eosin stain; 1.4 mm. obj.; 4x oc.; ×600.)

Some men hold that if the calculus is not removed soon after it forms, the gland undergoes degeneration and should be removed. The duration of a calculus cannot be determined by the onset of symptoms. Disturbances are noted only

Glands that felt hard and taut returned to normal after the calculus had been removed. It is reasonable to assume, therefore, that probably only a portion of the gland exposed to suppuration and the direct irritation of the for-

eign body is impaired to such a degree that the secretory cells are destroyed or damaged beyond repair. It is a fair assumption that this portion or lobe becomes obliterated by the development of cicatricial tissue.

Peculiarly, the removal of the parotid gland is not advocated for the cure of salivary calculus. It may be that the greater difficulty of this operation, the attending injury to the facial nerve and the inevitable scarring, with the resultant disfigurement, are the deterrents therefor. We may point out that the removal of the submaxillary gland is also followed by considerable scarring. Some of the patients complain of permanent paresthesia of the tip of the tongue and a sense of dryness of the affected side.

Clinical experience does not seem to substantiate the supposition that a calculus which has formed in a gland is prone to recurrence. It may be of interest nevertheless to consider what may be regarded as a recurrence. The citation of two cases will illustrate some errors in diagnosis in this regard:

Miss M., aged 40, had been troubled with the symptoms of salivary calculus for about six months. Roentgenograms revealed the presence of a multiple calculus close to or partly lodged in the gland. (Fig. 6, left.) The calculus was supposedly completely removed. Suppuration from Wharton's duct together with a mild daily temperature persisted for about six months. Examination at this time showed that a portion of the calculus was left in place. (Fig. 6, right.) The patient was advised by several consultants to have the gland removed. Intra-oral removal of the calculus was successfully performed. All symptoms ceased and, after two years, there has been no recurrence.

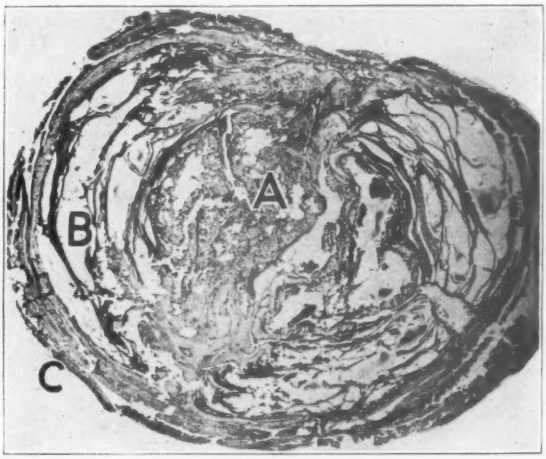


Fig. 11.—Calculus 7; showing characteristic arrangement in structure of Group II. *A*, focus; *B*, middle zone; *C*, outer shell. (Hematoxylin and eosin stain; 48 mm. lens; ×30.)

Recurrence is illustrated in the following case:

A man, aged 37, white, came in with an acute swelling in the right submaxillary area, Feb. 29, 1932. Drainage was established at this time. Roentgenographic examination revealed the presence of a sali-

vary calculus. (Fig. 7, left.) The calculus was removed March 16. The patient was dismissed with a good result, March 28. He returned, June 14, 1933, with a complaint of discomfort and slight recurrent swelling, which was not acute as in the first instance. Roentgenographic examination revealed at this time a new calculus formation. (Fig. 7, right.) This was removed, June 17, and the patient was dismissed, June 30. He reported back for followup examination, Dec. 6, 1933, and May, 1935, at which time his condition was normal.

If no definite diagnosis can be made in the early acute stage, the treatment should be that generally employed in acute suppuration. Localized pus should be evacuated and drained through an appropriate incision. Often the stone can be at once located and removed through the primary incision. When careful dissection becomes necessary, it is more advisable to defer removal until the acute symptoms have abated.

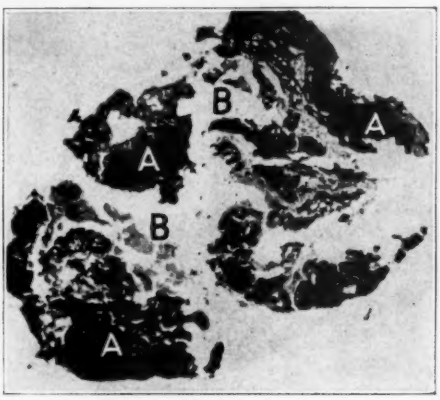


Fig. 12.—Specimen 9; showing characteristic arrangement in structure of Group III. *A*, structureless basic substance; *B*, phagocytes in various stages of degeneration. (Hematoxylin and eosin stain; 24 mm. lens; ×35.)

ELIMINATION OF THE CALCULUS

Spontaneous Expulsion.—This may occur even when the stone has formed in the gland or in a deeper part of the duct. It may be gradually propelled until it is passed through the orifice. The expulsion is always preceded by a variable degree of inflammation and disturbing symptoms in which the terminal portion of the duct may become succulent and enlarged and the stone escape through the enlarged opening.

Expulsion with Digital Manipulation or Pressure.—A calculus lodged in a proximal portion of the duct tends to drift forward. The propelling force may be the movements of the tongue or the muscles in the floor of the mouth or the pressure of the dammed up saliva. When at or near the orifice, the calculus can be more easily detected by inspection, because of the swelling, by discreet probing, by the use of roentgen rays or by palpation. On gentle pressure from behind, the stone, if not too large, may be forced through the orifice.

Too much pressure on the calculus should be avoided, especially when it is so large that it distends the duct. If it

is crushed, the removal of all particles is uncertain and more difficult. Fragments left behind may become the nidus for secondary calculus formation.

intra-orally under local anesthesia, obtained by blocking the lingual nerve in the peritonsillar region and infiltration of the floor of the mouth. For calculi in

Fig. 13.—Outer crust of specimen 10. The compact arrangement of the radial fibers and transverse lamellae is evident. The pellicle *C* shows radially arranged threads, which are fungi. *A,* radial fibers; *B,* transverse lamellae; *C,* pellicle. (Hematoxylin and eosin stain; 8 mm. obj.; 4x oc.; ×450.)

Anesthesia.—In all operative cases here reported, the calculi were removed

the gland, these injections are supplemented with infiltration extra-orally

about the gland. Injections immediately about the calculus should be avoided as the inundated and distended tissues make the calculus less discernible on palpation.

stone. The tissue is lifted until it is well stretched over the probe. The incision is carried to the probe and the lumen of the duct is exposed. The stone, when brought

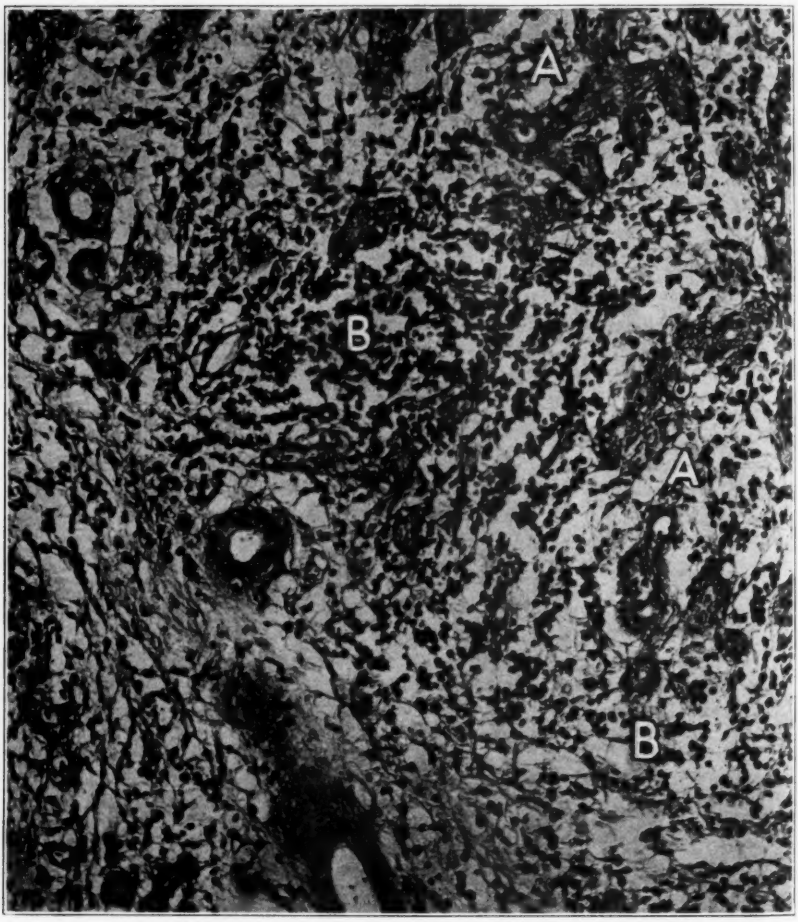


Fig. 14.—Section of submaxillary gland from which stones 11 and 12 were removed. Destruction of the glandular epithelium *(A)* and infiltration of leukocytes *(B)* are evident. (Hematoxylin and eosin stain; 16 mm. obj.; 4x oc.; ×250.)

Removal from the Duct Through Incision.—In this operation, a probe may be inserted in the duct clear to the

to view, can be removed with pliers or a curet or may be expelled with forward finger pressure.

Incision of the duct does not result in cicatricial stenosis, as is advanced by some. From my experience, this expectation is unfounded. The orifice of the incised duct often remains larger than it was originally. The incision can be made with this method, somewhat posteriorly to the outlet, the tissues over the divided duct being sutured.

Removal from the Gland Through Intra-Oral Incision.—Calculi lodged in the gland proper are not always easily lo-

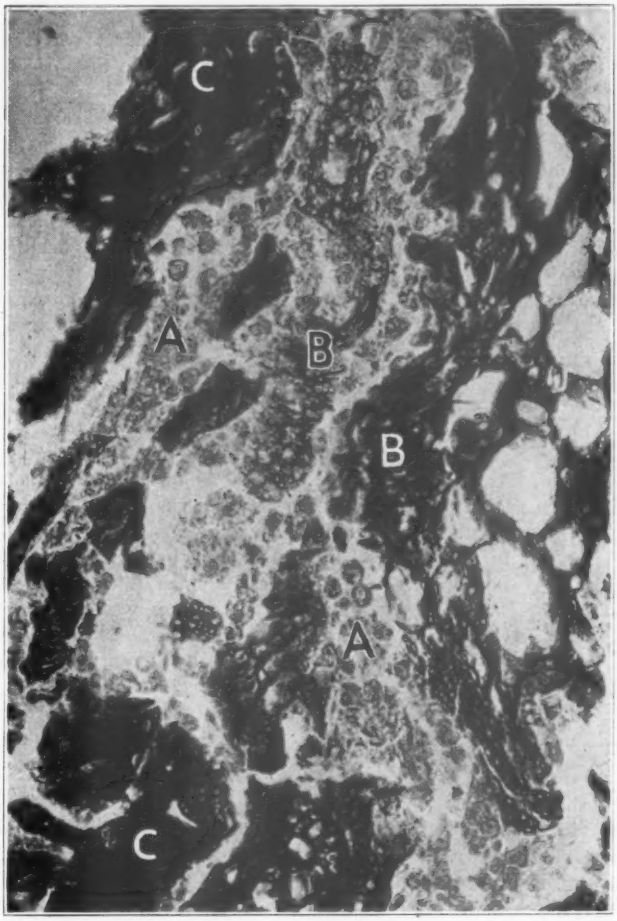


Fig. 15.—Cross-section of specimen 8, showing darkly stained strands of fibrinous substance circumscribing individual and clusters of degenerated phagocytes. *A*, degenerated phagocytes; *B*, thin anastomosing strands of fibrinous substance; *C*, thick masses of basic substance showing cellular areas. (Hematoxylin and eosin stain; 8 mm. obj.; 4x oc.; ×450.)

cated. The stone, as a rule, cannot be felt by probing Wharton's duct even to its deepest limitations. Tactual localization should be aided by the use of carefully made roentgenograms. Palpation is of definite aid and gives reliable guidance. In the removal of these calculi, the duct is left intact.

The mucous membrane is incised over the point where the calculus is felt, about a quarter of an inch medially from the inner surface of the mandible. With sharp and blunt dissection, the mylohyoid muscle is reached. It is important not to traumatize or sever the lingual nerve, which crosses Wharton's duct and often becomes exposed. The muscle is divided next, and the assistant forces the gland with finger pressure into the floor of the mouth. When the stone is thus located, the overlying tissues are divided until it is reached and removed.

Bleeding vessels are ligated and the wound is closed. An iodoform gauze drain is placed in the deepest portion of the wound. Cicatrization is usually prompt and uneventful. Secretion of the saliva appears to be uninterrupted. Traumatization of the lingual nerve causes some transitory postoperative discomfort.

Removal of the Stone Through an Extra-Oral Opening.—This operation may be indicated when the stone is demonstrated to be in an entirely inaccessible portion of the gland and its removal through the intra-oral route is uncertain.

A HISTOPATHOLOGIC STUDY OF THE STONES REMOVED

The differences in the concepts of the structure and etiology of salivary calculi are probably due, in part at least, to the various technics used in their study.

It is practically impossible to isolate the bacteria of the concretions without mouth contamination. The fact that the site of operation in the removal of the calculi is mostly submaxillary may account, in a measure, for contamination and the varied bacteriologic findings. In the reported findings of micro-organisms, insufficient evidence was brought forth as to their rôle in the formation of these concretions.

An important source for varied opinions may lie in the preparation of the microscopic sections. The comparatively few calculi sections by other investigators were decalcified with picric acid, trichloracetic acid and acidified Bouin's. With these reagents, from one to two or more months was required to decalcify the calculi. This prolonged processing may be responsible for the difficulty in disclosing the microscopic details of the specimens.

Technic of Examination.—The stones were placed in 10 per cent formalin immediately on removal. Photographs of the specimens were made and they were subjected to roentgenographic study. After gross inspection, some of the stones were divided into a number of parts, which, in turn, were used for ground and decalcified sections. Others were decalcified *in toto*. Fourteen stones were examined as outlined.

Most of the stones were smooth; others presented many irregular surface excrescences. The calculi cut transversely usually revealed grossly a concentric arrangement of layers. The slices crumbled readily under slight pressure. The line of cleavage usually occurred along the planes of the lamellae.

The best specimens were obtained with dilute nitric acid decalcification of small particles and even whole calculi, the concentrations used varying from 5 to 15 per cent. Decalcification was usually complete in from twenty-four to seventy-two hours. After thorough washing,

they were dehydrated and embedded in hard paraffin. All specimens were cut between 5 and 10 microns; most at 5 microns. The decalcified specimens were stained with hematoxylin and eosin and, when necessary, with trichrome, Laidlaw silver, Gram and mucicarmine and, in some instances, with iron stains.

In the preparation of the ground sections, the surface of the specimen was dried thoroughly and was then fixed in a metal trough with molten paraffin (58 C.). After the block was chilled well, the trough was fixed in position and the stone was cut with a fine-tooth saw.

These transverse sections were first dehydrated, the specimens remaining in 70 per cent, 95 per cent and absolute alcohol, twenty-four hours in each. The segments were next placed in chloroform and, on the following day, were placed for forty-eight hours in a jar of thin kollolith (a specially prepared Canada balsam). After this, the specimens were placed in thick kollolith, heated in a water bath until all the air was expelled, and then permitted to dry on a pliable lead plate for at least a week. The hardened block was then ground on one side, a ground-glass plate or wheel and fine pumice being employed. The desired surface having been obtained, it was washed free from grit, brushed with chloroform and cemented on a glass slide with chloroform resin. The slide was placed in an oven (58 C.) for one week, then chilled thoroughly, and ground to the desired thickness. The surface was stained with hematoxylin and eosin. (The use of acid celloidin and the method of grinding of calcified specimens were devised by Charles F. Bödecker.)

Roentgenographic Study.—In roentgenograms taken with the customary exposures and developing, most calculi appeared to be radiopaque bodies and cast clearly outlined, structureless images. By varying the exposure, distance and developing for the individual stones, alternate light and dark striations were observed.

A good roentgenogram almost always disclosed a laminated structure and a radiopaque or radiolucent central nidus. (Fig. 8.) In the more densely calcified stones, the lamellae usually appeared as distinct radiopaque rings. The structure of some was only faintly shown in the roentgenogram. Such poor calcification may account for the fact that certain calculi cannot be demonstrated in some instances in the presence of obstruction of the salivary ducts and glands.

Histologic Study.—The ground specimens corroborated the presence of laminations as shown in the roentgenograms. The periphery consisted of concentric layers of calcified substance which, in arrangement and in staining with acid and basic dyes, strikingly resembled cortical bone. The central portions of the calculi consisted of irregularly arranged islands, which formed isolated or confluent masses and were composed of two structures: (1) a fairly homogeneous basic substance and (2) ovoid calcified bodies. The latter frequently displayed a central or an eccentric dark area. In many, Liesegang rings could be observed. In one stone, the central focus consisted of a clump of bacteria about which a multitude of globules, above described, were observed. Micro-organisms were not seen in the other ground specimens.

Specimen 1 (Fig. 9) is a section through the center of the stone. Two distinct structures were present. The outer portion, which forms a shell, was rather regular in outline. Closely packed laminations could be seen in the outer layer which, in its histologic appearance, resembled cortical bone. The entire substance stained very lightly with hematoxylin and eosin. The inner portion

consisted mainly of opaque, globular bodies held in a basic substance that stained lightly with acid dyes and contained basophilic patches. Some globules were quite transparent. The variations observed are not likely to be caused by insufficient dehydration as this was avoided by the technic used in the preparation. The transparent globules often presented Liesegang rings; while, in others, central and eccentrically placed circular areas were seen. It will be shown later that these bodies are calcified phagocytes. In the center of the nidus was an ovoid area containing small, deeply stained (hematoxylin) bodies, which, in size, shape and distribution, had the characteristics of bacteria. The transparent and opaque globules were closely packed about the periphery of this core.

The microscopic findings and the indication of a definite organic framework prompted the study of decalcified specimens. The stones varied greatly in their histologic structure. The basic substance, i.e., the organic matrix, which remained on decalcification, was the same in most specimens. It varied in internal arrangement and microscopic inclusion.

On the basis of the arrangement of their histologic structure, the calculi may be classified into three groups: (1) dense substance, traversed by microscopic bands and resembling compact bone; (2) laminated substance, fairly regularly arranged about a distinct central nidus, and (3) irregular islands of basic substance having no definite pattern. This type was found only in small calculi.

There was only one specimen in Group I. (Fig. 10.) This calculus was treated with acid celloidin and was cut at 10 microns. As the structures showed no evidence of distortion, this type may be considered, not an artefact, but the result of an unusual condensation of the organic substance. The basic substance, as previously stated, is the same in all three groups.

Most of the stones studied are of Group II. The histologic appearance corresponds to the gross, roentgenographic and microscopic findings described. The calculi presented the following internal arrangement: 1. The focus. This usually consisted of several irregular masses of basic substance in and about which were found well preserved and degenerated phagocytes. In two cases, clumps of bacteria were found in the nidus. In one, elliptic forms of the size of phagocytes, studded with cocci, were seen, which may be bacteria-laden pus cells. 2. The middle zone. Between the nidus and the outer layer were irregular laminations of thin and thicker strands of basic substance which interlaced at various points. This delicate mesh extended practically to the surface of the stone. (Fig. 11.) 3. The outer crust. This consisted of very dense laminated structure. The basic substance was usually composed of two types of fibers differing in their direction and thickness. The radial fibers were thin and numerous. Very frequently, they presented brushlike bundles converging to an apex toward the periphery. The thicker transverse fibers were fewer and stained more deeply. The arrangement of this structure recalls the histologic picture of osteoid and dentinoid tissues. (Fig. 13.)

A pellicle or a layer of poorly calcified substance of varying thickness was sometimes found about the circumference of the specimens. This layer was readily detached in decalcification. It varies in thickness and, in certain stones, is reduced to an insignificant ring. In well-preserved specimens, the pellicle presents short radial fibers (fungi), which seem to rest on the outermost lamella. Frequently, bacteria, pus cells and some epithelial cells can be seen. In some instan-

ces, this structure is not unlike that found in coronal dental tartar (Berke,[17] 1935). (Fig. 13, *C*).

Phagocytic cells have been observed in all calculi. They were most numerous about the focus and decreased in the outer crust, which was usually quite free from them.

Coccoid forms with characteristics of bacteria in size and distribution have been found in the foci of two calculi. In several stones, their presence was suggested. In others, phagocytic cells were seen, but there was no evidence of microorganisms. In the substance of these calculi, dark coccoid bodies have been observed in diploid, clump and sometimes irregular chain formation. Variations in their size were not characteristic of bacteria. Epithelial cells have not been found in the foci or basic substance of any of the salivary calculi.

The calculi of Group III were invariably small. In size and structure, they were comparable with the foci of the larger calculi described in Group II.

Specimen 3, Figure 10, was in the first group. It was a solid, roughly elliptic mass, and stained unevenly with hematoxylin and eosin. It consisted of two distinctly different arrangements of basic substance. The more nearly central, lightly stained part presented deeply stained microscopic bands traversing the basic substance. In certain regions, the bands were arranged concentrically. The centers of many of these areas contained phagocytic cells, a number of which were well preserved in the basic substance. (Fig. 10, *A*.) The outer part of the stone was dense and more darkly stained. Few bands could be seen in the areas. Units and clusters of phagocytic cells were visible in the basic substance. In some regions, the bands were arranged concentrically. The centers of many of these areas contained phagoctic cells, a number of which were well preserved in the basic substance. High power studies revealed lacunar spaces that probably had contained cellular elements. Gram stains were negative. A small central patch stained with mucicarmine. Laidlaw's silver stain for collagen brought out many details in the matrix that could be barely seen by other staining methods. Whereas the greater part of the substance seemed to be lacking in structural detail, this stain revealed innumerable "lacunae" and bands. The bands ran parallel with the surface of the calculus. There was a concentric arrangement and, in many areas, fibers perpendicular to the outer surface and the lamellae could be seen. Professor Laidlaw has found that fibrin from the plasma of cell cultures may be stained with silver. It is also possible that the presence of residual calcium influenced the stain. The staining and histologic structure are suggestive of the microscopic appearance of a compact bone.

The larger and well-calcified stones were usually found in the second group. Dilute acid decalcification was used in the preparation of these specimens. In these, the laminated basic substance was regularly arranged about a central nidus. Roentgenograms revealed characteristic internal arrangement. (Fig. 8.)

Figure 11 is a photomicrograph of a typical section. The outer ring was compact and presented a basic substance composed of radial fibers that were traversed at regular intervals by thicker concentric bands running parallel to the surface. (Fig. 13.) The fibrous nature of this substance was not evident in ground sections. Between the central nidus and the outer shell were numerous delicate concentrically arranged and interlacing strands of substance similar in arrange-

17. Berke, J. D.: D. Cosmos, 76:134 (Feb.) 1935.

ment to the outer crust. The disposition of the fibers and lamellae was not so regular. In the zone, secondary foci frequently occurred about which lamellae were arranged. These disturbed the uniformity of the adjacent substance and seemed to produce excrescences on the surface. They were also found at times in the outer shell. Serial sections sometimes revealed phagocytic cells acting probably as secondary foci for this deposition.

The central nidus consisted of the arborization of thick and thin strands of a structureless substance in and about which there were clusters of phagocytes. The central mass presented numerous spaces which were probably due to dislodgment of cells and which gave the basic substance a spongy appearance. The greatest number of phagocytic cells was found usually near, or in, the central core. This cellular and delicately formed nidus was preserved by the numerous fine interlacing strands of basic substance that formed the middle zone. (Fig. 11, *B.*)

Stone 9 presented the characteristics of the third group. (Fig. 12.) The stones in this group were all smaller. The structure consisted of porous, irregular masses that intertwined in the different planes of the section and presented numerous spaces that decreased toward the periphery. In the central parts, a multitude of cells were seen, mostly polymorphonuclear leukocytes in various stages of degeneration. Some of the cells were found to be in the interstices of the islands, while others were completely embedded in the basic substance. As the phagocytes were found embedded in the basic substance, we may conclude that a fibrinous matrix was formed first about these cells, which later became calcified. The high cellular content and the spongy structure may account for the marked radiolucency of this group of calculi. It is interesting to observe that the basic substance of these stones, as well as that of the foci of Group II, showed neither fibers nor laminations, but appeared to be homogeneous. The size and structure of the stones in Group III closely resembled the foci of the larger calculi.

All the calculi described heretofore were of primary occurrence. One secondary specimen of the series here reported will be described as being of special interest. Specimens 3 and 10 were removed from the same patient at an interval of about fourteen months. Specimen 3, the first one removed, was of a dirty grayish hue, and somewhat flattened and presented several conical excrescences. It was lodged at about the origin of Wharton's duct. The conical masses probably projected into the interlobar ducts. Specimen 10 was much lighter in color and spherical. The surface was marble-like and unusually smooth. The internal arrangement of these two calculi was also dissimilar. The structure of the first is described above as the only specimen in Group I. It was a solid mass and contained inflammatory cells. Its internal structure could be best distinguished with silver stains. Specimen 10 was a typical stone of the second group, the outer crust and middle zone presenting the already described characteristics. Brushlike bundles of radial fibers were regularly intersected by transverse lamellae. (Fig. 13.) The radial and transverse markings were especially distinct. The focus included pus cells and a cluster of coccoid microorganisms. As in the other specimens, the cellular elements diminished toward the periphery. An unusual number of inflammatory cells was present. In sharp contrast to the other calculi, the internal basic substance consisted of a multitude of mycelial forms, bacteria and phagocytes.

Stones 11 and 12 were removed by another surgeon, together with the submaxillary gland. In microscopic study, their foci were found to consist of "cell ghosts." The larger stone was firmly adherent to the walls of the duct; which caused an almost complete obstruction. The epithelium of the duct was degenerated. Pathologic changes were found in the gland proper. (Fig. 14.) The secretory cells were destroyed in many areas. In many, they were distorted and the stroma was densely infiltrated with polymorphonuclear leukocytes, plasma cells and lymphocytes. No micro-organisms were seen in the sections.

It is notable that in the treatment of all the other cases, the glands were not removed. Undoubtedly, pathologic processes have occurred in all instances. We must reasonably assume that the damage caused is capable of repair, as, with the conservative treatment, no untoward complications developed and function remained normal.

COMMENT

Roentgenographic and microscopic observations of salivary calculi have revealed, in every case, a focus about which the mineral salts were deposited. These foci appeared to be composed of several constituents: inflammatory cells, bacteria in several instances and, with one exception (No. 10), a nonfibrous basic substance. Phagocytic cells of normal appearance and in various stages of degeneration were found free in the interstices and incorporated in the basic substance. Individual and clusters of cells were circumscribed by the mass. Coccoid bacteria were demonstrated in some, but not in all cases. In certain instances, these elements were probably so incorporated in the enmeshing framework that, after calcification, it was almost impossible to recognize them. The basic substance of the focus was nonfibrous. The enlargement of the calculus continued, usually in fairly regular laminations, which formed the middle zone and the outer crust. The basic substance of the peripheral parts of many calculi showed a radial and concentric arrangement of the component fibers.

The arrangement of the focus can be traced in Figure 15. A multitude of degenerated leukocytes of the polymorphonuclear type are seen in the internal spaces of the loose organic framework. A deeply stained fine reticulum appears in the most nearly central area, which, in variable degrees, surrounds individual clusters of cells. In the denser parts, fragments of these cells are seen incorporated in the delicate network. In the more complete enclosures, the intercellular threads were thicker and formed deeply stained islands, which contain ovoid bodies, obviously cells. With the extension of the basic substance, larger zones of organic matter are formed, which may or may not evidence cell "ghosts."

The nature and distribution of the basic substance is of importance in the interpretation of the mode of formation and incremental growth of these concretions. It has been indicated that the organic matrix in and about the focus seemed to be fibrinous. The fibrin was probably derived from inflammatory exudates. The likelihood of an inflammation as a factor in the etiology was suggested by the consistent presence of phagocytic cell "ghosts" in the foci of all of the calculi studied. In some stones, mycelial threads constituted the bulk of the outer basic substance, but they could not be demonstrated in all specimens.

SUMMARY AND CONCLUSIONS

1. Recurrent enlargement of the gland on increased salivation and per-

sistent pus discharge from Wharton's duct are pathognomonic signs of salivary calculus. These symptoms and signs may occur even when the calculus is not sufficiently calcified to be demonstrated in the roentgenogram.

2. The persistence of the calculus, suppuration and recurrent inflammatory processes do not necessarily destroy the parenchyma of the entire gland, as evidenced by the preservation of its function.

3. The elimination of the calculus is of paramount importance in the treatment of the ailment, since, with its removal, all symptoms ceased in the cases treated by this method.

4. The extirpation of the gland is only rarely indicated.

5. In most cases, operation can be performed by the intra-oral route.

6. Local or regional anesthesia is well adapted to operations for the removal of salivary calculus.

7. In the histologic examinations, a focus composed of phagocytic cells, bacteria or both has been found in all specimens on microscopic examination.

8. The inner basic substance, and, in some instances, the outer basic substance, was probably primarily fibrinous and was derived from inflammatory exudate.

9. The nature and the contents of the foci strongly suggest that inflammation of the gland and possibly of the duct preceded the formation of the calculi.

10. There is no definite reason to believe that the micro-organisms of the mouth alone are responsible for calculus formation.

11. It may be an interesting observation that all of these patients were white and of different nationalities. No calculus was seen in colored people, nor have we seen any case cited in the literature. It is probable that they are immune to calculus formation.

A DEFINITE AND DEPENDABLE THERAPY FOR PULPLESS TEETH*

By ALFRED WALKER, D.D.S., New York City

ONE of the most embarrassing situations with which a dentist may be confronted is the occurrence of pericementitis in the course of treatment of a pulpless tooth. This unfortunate reaction may occur at any time during treatment. In many instances, it will follow the initial treatment of a tooth which, up to the time of dental interference, has caused the patient no local discomfort. It may occur after the removal of a vital pulp, or in connection with a tooth which, prior to treatment by the dentist, had exhibited only an intermittent mild chronic form of pericementitis. The picture is a familiar one. Within twenty-four hours after the patient has left the office, pericementitis develops, mild at first, but steadily increasing in severity. Sometimes the rate of increase is slow; at other times, it is rapid, and

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

may be accompanied by swelling and a rise in temperature. The fever may be severe, 103 degrees being common, and unless the condition is checked, cellulitis, with all its accompanying distress and incapacitation, may follow. This complication is embarrassing, not alone because of the intense suffering and discomfort to which the patient is subjected during the course of this acute disturbance, but also because the complex incidents that may follow are liable to be of serious consequence. At least one death has been reported which, it is asserted, was traceable to a tooth thus involved.

If it were not possible to avoid this and other unpleasant complications that may arise in the treatment of pulpless teeth, there would be little excuse for this article. The principles that I shall enunciate have been stated on previous occasions by others as well as by myself. These embrace the simple but exacting rules of cleanliness, and cleanliness in the surgical sense. This means that not only must the field be isolated by the use of the rubber dam, and sterilized by employing suitable germicides, but also everything that comes in contact with the field of operation must be surgically clean. In addition, precautions must be taken against infected material from within the canal reaching the periapical area. While the introduction of bacteria into the field by means of contaminated instruments or dressings may be a contributing factor, the real exciting cause of acute disturbances beyond the root-end is the invasion of this area by bacteria from the canal itself. This is not theory, but a fact that has been observed time and again, and yet, in spite of this knowledge, many operators continue to take chances by neglecting to observe the simple precautions necessary to safeguard the patient. To explain this state of affairs is not difficult. We all know how frequently the rules of asepsis are slighted in the routine of the dental office. Such simple operations as cavity preparation and filling, which make up the bulk of general practice, are often undertaken without the strict observance of cleanliness in the surgical sense. The procedures followed are designed to satisfy the patient's ideas of cleanliness rather than to meet the standards of true asepsis. When extractions or other operations involving the soft tissues are undertaken, extra precautions are usually observed, but even in these instances, strict adherence to the rules of asepsis is not always the case. Pulp-canal therapy, being a highly specialized procedure, demands the closest possible attention to every detail of sterilization and manipulation. The operator must be on the alert always, to guard against not only breaks in the chain of asepsis, but the many other eventualities that may contribute to failure.

All instruments and dressings used in pulp therapy should be carefully selected and sterilized. They should be kept apart from other instruments and in such a way as to maintain their sterility. When the operation is to be undertaken, everything to be used should be assembled beforehand, that the operation may proceed in an orderly and expeditious manner. This may be done with little effort if the operating instruments and dressings, after being sterilized, are placed in units, each complete within itself and instantly available for use. A suitable resterilizing medium must be provided for use during the operation. The field must be isolated and sterilized before any actual operative steps are taken. Every possible precaution must be observed for the maintainence of cleanliness throughout the operation. The rubber dam provides the best means for isolating the field, and its use is imperative. The reluctance of many dentists to use the dam is difficult to understand,

for it not only provides the necessary protection, but also enables the operator to work with more thoroughness and greater ease and speed.

Since it is a fact that an infected root canal may harbor bacteria capable of causing serious local or general injury, the protection of the patient is of paramount importance. Therefore, measures designed to provide this protection cannot possibly be too exacting. Unfortunately, the importance of this fact has not been generally recognized. It is my belief that all dental operations of whatever nature should be carried out with due consideration for asepsis, the rules to be modified only when it is certain that no damage will result from such modifications. In the dental school, the importance of cleanliness should be stressed throughout the entire course. Even in his technical work, the student should be required to observe asepsis, so that when he begins his infirmary work, he will follow such a technic as a matter of course. Students receiving instruction in clinical pulp-canal therapy should be taught in small groups and by special instructors. The instructors should be sufficient in number to maintain close and constant supervision. Infirmary classes in pulp-canal therapy should be segregated, preferably in a separate room, or by means of some arrangement that will prevent the diversions constantly present in a large general infirmary room. In addition to the instructors, there should be a trained attendent who understands the rules of the surgical operating room. The attendant's duties should include the sterilization and care of instruments and dressings.

It is not my purpose to attempt to cover every phase of the treatment of the pulpless tooth. I do wish to present an outline of the prefilling treatment of these teeth, which, I believe, will leave no doubt as to the soundness of the procedure, and of the certainty of complete control at all times during the treatment period. If the principles upon which this outline is based are faithfully carried out and a careful filling technic is adhered to, many teeth that are needlessly sacrificed may be saved. Since the paper is confined to the purely clinical aspects, we shall not discuss the bacteriology or the histopathology of the subject. Not that they are not important, but they could not be given adequate consideration here. I shall outline what I consider a definite and dependable prefilling treatment for pulpless teeth. Temptations to "short cuts" that may in any way or degree violate accepted principles must be shunned. The operator must concentrate on the operation at all times and he must be alert against possible breaks in the chain of asepsis. If the technic is carefully followed, acute reactions will be eliminated. The procedure that I shall outline is not based upon theory. Its effectiveness has been demonstrated time and again. Experience has convinced me that when acute reactions do occur, the responsibility is the operator's. Many years of observation and endeavor in this field have demonstrated that as refinement of technic improves, the incidence of acute reactions and other unfavorable happenings will diminish to the vanishing point.

For treatment purposes, we may divide pulpless teeth into three general types. Each type presents certain variations and there is a definite treatment procedure that should be followed for each type. The atypical cases or those that present conditions suggesting special treatments will be recognized by the operator, and his judgment should dictate the procedure, the basic principles being ever kept in mind, and whatever treatment is introduced being in conformity with these principles.

I believe that we are in general agreement concerning the actual or potential menace of the infected tooth, and that, in every instance, the infection should be eradicated, either by the removal of the tooth or by more conservative means. It will also be understood that, in certain instances, the removal of the tooth affords the patient the best protection. On the other hand, there are many pulpless teeth that are amenable to conservative treatment. Success will depend on careful diagnosis and, to repeat, a rigid adherence to the principles of surgical cleanliness from start to finish.

Before proceeding with a detailed description of the treatment procedure, it will be well to discuss the sterilization and care of the instruments. Until within the past year, it has been my custom to sterilize all instruments by means of boiling, but I have never found it entirely satisfactory because of its harmful effects on the delicate and finely tempered root-canal instruments. Heating not only affected their working qualities, but it also affected their finish. For the past year, I have been using a formaldehyde germicidal agent, which has proved very satisfactory. In using this preparation, not only is the temper of the instruments preserved, but also the brightness and luster of the finish is retained. The solution which I have been using has been tested for bactericidal properties and the results have been eminently satisfactory. As stated before, the root-canal instruments should be kept separate from the general operating instruments. At the New York University College of Dentistry, we are using metallic boxes for this purpose. The boxes are provided by the college. The student, on entering the course in pulp-canal therapy, is assigned a box, in which his instruments are placed by the nurse in attendance. The instruments are sterilized and handed over to the student each morning when he begins his infirmary work. The sterilizing unit is provided for use on the bracket table for resterilization. In my own practice, I am using containers made of heavy unbleached muslin in which taped pockets are sewn. In each of these containers is a complete set in duplicate of instruments for opening and preparing the canal. Another container of the same material, but without the pockets, holds a set of instruments for use in the filling operation. The sterilizing unit is used for sterilization. To proceed with the treatment phase of this presentation: The roentgenogram having been carefully studied and the diagnosis suggesting conservative treatment, the teeth that are to be isolated by the rubber dam are relieved of all tartar and débris. The operator being certain that there are no obstructions to prevent the easy application of the dam and that there are no sharp surfaces that will cut it, the teeth and gums are swabbed with iodine and the dam is applied, after which the isolated teeth and the dam surrounding them are again swabbed with iodine and then washed with alcohol. The next step is to cut away the overhanging enamel and then remove all carious material from the cavity. This very important, but often neglected, procedure should never be overlooked as it is undoubtedly the cause of many failures. All the carious material having been removed, and with free and unobstructed access to the canal, the cavity is then swabbed with eugenol or phenol, and then swabbed with 70 per cent alcohol. Entrance to the pulp canal is now undertaken, the operator making certain, of course, that all instruments, absorbents and dressings are surgically clean. Even though the instruments had been previously sterilized, it is well to pass them

rapidly through the flame of an alcohol lamp before carrying them into the operative field. After removal from the field, they should be wiped with sterile gauze, a piece of which may be fastened with the patient's towel fastener. Instruments are then dropped into the sterilizing solution and left therein until they are to be used again, when they are removed, dipped in an alcohol rinse and again passed through the flame before being carried into the operative field. Absorbents and dressings should not be left exposed, but should be wrapped in, or kept between, layers of sterile gauze.

Whether the case be the removal of a vital pulp or the treatment of an infected root canal, the same precautions should be observed, except that when a vital pulp is removed, the canal should be completely cleansed in one operation; whereas, in infected cases, extreme caution should be exercised against extending the operative procedure beyond the incisal two thirds of the canal. I wish to lay great emphasis on this point because, in my opinion, the sole cause of pericementitis is carelessness from the standpoint of asepsis in general and the forcing of infected material through the apical foramen. This is liable to happen when the operator ventures into the apical third of an infected pulp canal without previously disinfecting the contents of that area. This rule applies to those cases that do not manifest symptoms as well as those that do. Whether the immediate cause of acute periapical reactions is a symbiosis or a transmutation of micro-organisms is for the moment beside the question. The important point is that the operator must use every possible precaution to prevent the extrusion of infected material beyond the root-end. It is in the treatment of pulpless teeth which manifest no symptoms that the temptation to completely cleanse the canal at the first sitting is greatest. This must not be done.

In treating these cases, every aseptic precaution must be taken. The incisal two-thirds must be cleansed, and thoroughly, with great care to avoid forcing infected material beyond the area being cleansed. In irrigating or flushing out the canal, only sterile warm water is employed and flushing is done very gently. The field is cleansed completely as we progress into the canal. No débris or infected material is left in the path of instruments or dressings, and when the desired point has been reached, the canal is dried with a sterile absorbent. Compressed air is not used. A reliable germicide (I prefer formocresol) is sealed in the canal, but in such a way that it will not seep into the mouth and mouth fluids cannot enter the canal. This dressing should not be left in for more than forty-eight hours, twenty-four hours being preferable. At the next visit, the canal may be completely cleansed. Of course, all precautions outlined for the initial treatment must be observed. Should there be a reaction, it can, to a certainty, be laid to some error in the technic. The patient should always be instructed to report immediately any symptoms of pericementitis. Arrangements should be made for an immediate appointment, and the dressing removed under the prescribed aseptic precautions. Then, with a plain broach, the operator ascertains whether the canal has been blocked. If it has, the operator carefully breaks through by means of instruments and solvents, gently flushes the canal with sterile water and dries it, sealing formocresol in the canal for twenty-four hours. This will usually be sufficient to allay the symptoms, although, in some instances, several treatments may be necessary. In these cases, daily treatments should be

instituted. Should the case get beyond control, the treatment will be suggested by the developments. Such treatment may involve incising or extraction.

In treating pulpless teeth manifesting symptoms of pericementitis, the procedure is identical with that prescribed for teeth not so involved. If all precautions are observed, the tooth being carefully opened, the canal cleansed up to the beginning of the apical third and formocresol sealed in for twenty-four hours, the symptoms will as a rule subside within this period. If not, the treatment should be repeated, the operator making certain that the canal is not blocked, as otherwise the disinfectant cannot reach the infected material beyond the blocked point.

In the treatment of infected pulpless teeth attended by severe pericementitis and marked swelling, it is of course important to establish immediate drainage through the pulp canal. Failing in this, the operator should resort to surgical measures. After drainage has been established through the canal, the patient should be kept in the office until there is noticeable, but not necessarily complete, relief from the pericementitis, and until any discharge has perceptibly diminished. This may be brought about by alternately flushing with sterile water and using sterile absorbents. When the discharge has diminished to the point that it ceases to flood the canal, formocresol may be sealed in for not more than twenty-four hours. If the patient is seen for the first time in the morning, he should be seen again in the late afternoon or evening, the flushing being repeated and formocresol again sealed in. This treatment is repeated once on the following day, and daily until the discharge has diminished sufficiently to permit the complete cleansing of the canal. Three or four days should prove sufficient. If the cleansing is then carefully carried out, there will, in turn, be complete cessation of the discharge.

When I refer to the complete cleansing of the canal, I do not have in mind what is so often accepted as evidence of complete cleansing; i.e., a roentgenogram showing a wire projected to or through the end of the root. Complete cleansing, as I understand it, implies that every vestige of débris and infected organic material is removed. There is no doubt that failure to carry out this requirement is responsible for most of the disturbances incidental to prefilling treatments, and the reactions and failures following root-canal filling. In cases attended by a pericementitis, the patient will be more comfortable if the occlusion is relieved by grinding.

Some operators limit pulp-canal cleansing technic solely to mechanical cleansing. My experience has convinced me that the judicious use of suitable chemicals proves helpful. For this purpose, I have found double strength chlorinated soda solution (National Formulary, Fifth Edition), suggested by Dr. Blass, of New York University, very satisfactory. In addition to being an organic solvent, it is a powerful germicide. While it has no apparent ill-effect on living tissue, it should be used in quantities only sufficient to attain the desired result. Two or 3 minims at the most should suffice for the average canal. Formocresol should be used in minute quantities. If paper or cotton points are used for carrying this disinfectant, only the very tip of the point should be moistened.

While much of the foregoing may seem elementary to some, I venture to present these ideas with the firm conviction that many dentists are condemning savable teeth to the forceps because they have failed to develop a satisfactory tech-

nic for the conservation of these teeth, and that many of those who believe that all pulpless teeth should be removed will find in this presentation ample grounds for reflection and, I hope, for a revision of their ideas.

It is unquestionably true that sad experience with acute reactions has caused many of us to refrain from treating pulpless teeth. It is also true that fear of the same complications is causing many to practice the long-drawn-out drainage method. This method is as unscientific as it is antiquated, and those who seek to defend it by comparing it with drainage as practiced in surgery are overlooking some basic differences. In surgery, the site of the operation is protected by sterile dressings. No such protection is afforded the periapical area when the tooth is left open. On the contrary, not only are septic conditions continued, but also the longer the so-called drainage is maintained, the more involved the periapical lesion and the tooth itself becomes, and, as a consequence, the chances of saving the tooth are lessened. Placing antiseptics in teeth and leaving them to the influence of seepage from the mouth is but a futile gesture, certainly having no desired effect on bacteria about and beyond the root apex. It is well known that germicides and antiseptics depend for their efficiency on definite degrees of concentration. When exposed to contact with mouth fluids, they quickly reach a point of dilution which renders them inert. This fact must be obvious to anyone who has removed such dressings after their brief tenancy in a pulp canal and whose olfactory nerves are still functioning. I have seen many teeth that were impaired beyond redemption because of these prolonged treatments. Oftentimes, under such treatment, the disorganization of the tooth root is so complete as to make recourse to extraction the safest course. The condition is not confined to a progressive destruction of the apical end of the root and surrounding tissues, but the walls of the canal itself become a soft mass removal of which would leave a structure so frail and with so little resistance that conservative treatment is beyond consideration.

Since we have at hand a technic that, if carefully followed, eliminates the possibility of acute reactions and enables the operator to control every step of the treatment and to complete the filling of the canal in from two to twelve days, can there be any possible necessity for extending the treatment over periods of weeks or months and, in most instances, meeting with failure?

SUMMARY AND CONCLUSIONS

1. Disease in the dental pulp and about the apices of pulpless teeth may affect tissues or organs in other parts of the body.

2. It is not safe to retain all pulpless teeth.

3. Under certain conditions, pulpless teeth may be safely retained.

4. Infecting organisms in and about the teeth may, in some cases, be removed by appropriate treatment.

5. Teeth which it is desired to subject to conservative treatment must be carefully selected.

6. The practice of leaving the pulp canals of teeth open and unsealed for the purpose of drainage is contrary to accepted surgical practice, is unnecessary and is, in consequence, bad practice. Such practice is not analogous to or comparable to surgical drainage of soft tissues, which provides for protection against possible invasion by outside organisms by means of dressings, bandages, etc.

7. Long-drawn-out treatments extending over weeks and months are un-

necessary and are detrimental to the health of the tooth and the patient.

8. Pulp-canal treatment, except when influences beyond control interrupt, should not extend over from ten days to two weeks. Most cases can be completed within a week.

9. Secret remedies are tabu. They invariably hold out as inducements saving of time and therapeutic promises that are not fulfilled.

10. So-called mummifying pastes are of questionable value and are designed to provide short cuts.

11. The area of dense bone that sometimes surrounds a radiolucent apical area may not afford the protection to the individual that is sometimes claimed for it because of continuity of circulation. These dense encircling areas may break down at any time.

12. Decisions concerning operations on multirooted teeth should be based on the same considerations as operations on single-rooted teeth, plus the operator's skill. The same therapeutic principles apply to both types of teeth.

13. The so-called strategic value of a tooth should never be given consideration in deciding on the disposition of a pulpless tooth. The tooth is either savable or it is not, regardless of its value as an item in planning a restoration.

14. The value of ionic medication has been demonstrated both experimentally and clinically and these demonstrations support the claims of those who use this medium in practice.

15. The choice of germicides and methods for disinfecting should be based on the proven value of the chemicals or the method employed. Certain disinfecting methods in use are slow in their action, requiring up to thirty minutes to destroy pathogenic bacteria. Others may be entirely ineffective. For example, the practice of immersing an instrument in alcohol and igniting the alcohol has no germicidal value. Tests have shown that a thermometer dipped in alcohol and ignited will not register more than 80 C.

16. There are five cardinal principles of pulp-canal therapy essential to success: diagnosis, free and unobstructed access, thorough cleansing of canals, use of a compact filling and a surgically clean technic from start to finish. Any technic that disregards these principles is not acceptable.

17. The rubber dam is indispensable.

18. When root resection is contemplated, the same careful prefilling and filling technic is as essential as when such an operation is not to be performed.

19. Pulp-canal operations require the highest degree of concentration and patience.

THE MEDICAL BACKGROUND OF THE ORTHODONTIC PATIENT*

By HAROLD J. NOYES, B.S., D.D.S., M.D., Chicago, Ill.

WE are experiencing an interesting change of emphasis in the attitude toward human disease. It was of primary importance that after their recognition, specific pathologic entities be studied individually in order that their particular character and manifestations might be determined. With the accumulation of this knowledge, we have come to realize that a more comprehensive understanding of these disease processes requires that they be related to the entire body economy.

From a medical point of view, the first problem of the human race was the relief of suffering and the cure of disease. As our therapeutic methods have improved, we have turned to the next logical step, the prevention of these conditions. While the leaders of both the dental and the medical profession have been interested in this phase of their science for many years, it is only recently that the average clinical practitioner has taken the matter seriously, and, even at the present time, this important field of professional service is sadly neglected.

The layman, through governmental and other social agencies, has displayed a keen interest in preventing illness and deformity. This is particularly true with respect to conditions in children. A notable evidence of this interest is the Whitehouse Conference on Child Health and Protection. The studies prompted by the desire to prevent illness in children have further emphasized the importance of a better understanding of the normal and a more comprehensive idea of the child as a whole.

This shift of concept is very evident in the science of orthodontia. It is clearly revealed in a review of the literature for the past twenty years. While the matter of mechanical and technical phases of orthodontics is of extreme importance, it must be remembered that they are only a means to an end. Of equal importance, certainly, is an understanding of the nature and the reaction, under varied conditions, of human tissues to mechanical forces. A knowledge of the normal background of the child, with particular attention to significant deviation, is of no less significance.

One of the interesting features in the practice of orthodontia is the opportunity it affords to study the child as a whole and to observe as well as to contribute to his growth and developmental progress. The dentist in general practice is seldom permitted as frequent contact; visits of or to the pediatrician are less regular. In spite of the possibilities which the character of the service implies, I find in most orthodontic records relatively little material suitable for a general appraisement of the child. In the few instances in which the oral as well as the systemic features of the child

*Read before the Section on Orthodontia at the Seventy-Seventh Annual Session of the American Dental Association,, New Orleans, La., Nov. 5, 1935.

have been recorded at pediatric clinics, the notations with respect to orthodontic details are usually inadequate; while in many of the orthodontic clinics of dental schools where the latter phase has received careful attention, important features of the medical background of the patient are lacking.

I feel particularly fortunate in having available records from the private practice of my father, Frederick B. Noyes. It has been his custom for twenty years to record not only the height and the weight of his patients, but in addition the incidence of disease. This, together with a careful roentgen-ray routine, has supplied material extending over a longer period of time and more comprehensive than would have been available from my own practice.

May I depart from the customary presentation of this subject? The treatment of the systemic factors in malocclusion has rather largely consisted of a recitation of the symptoms of certain disease entities, notably endocrine and nutritional disturbances, and is often followed by a discussion of the evidence or effect of the conditions with respect to the oral structures. Without detracting from the importance of these correlations, it may be said that the approach has certain disadvantages from the standpoint of the clinical practitioner of orthodontia. In the first place, as the material which will follow suggests, the orthodontic cases in which there is distinct evidence of systemic disturbance are relatively few. Furthermore, it is as difficult as it is unwise to attempt to place the orthodontist in the position of diagnostician with respect to distinctly med-

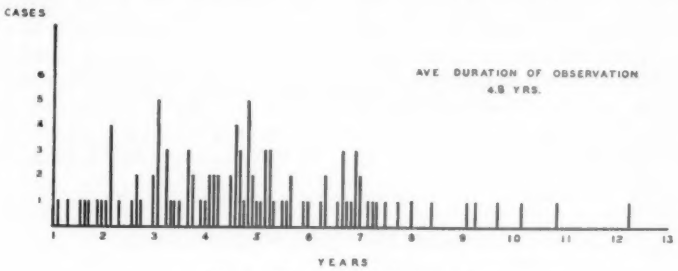


Fig. 1.—Duration of observation.

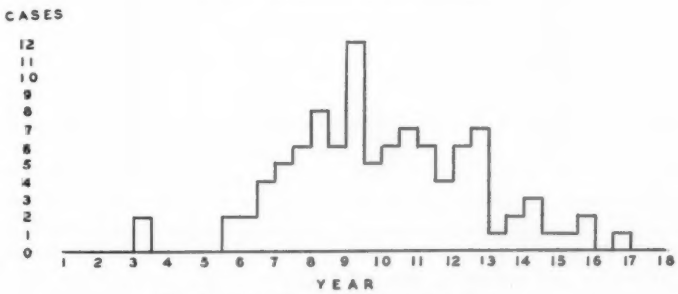


Fig. 2.—Age distribution, first observation.

ical problems many of which perplex the specialist in the particular field of the medical profession. And finally, it has created a tendency to emphasize certain systemic conditions far more than their relative importance in the field of oral deformities warrants.

In comprehensive studies of the child which are supplying data of increasing significance, we may find a method which is of more practical value to the orthodontist. From this point of view, I have developed this paper as a suggestion of experimental attack from a somewhat different standpoint. There is accumulating evidence that the normal child travels along a rather clearly marked highway in his progress toward maturity. The particular route as well as the destination is influenced or determined by circumstances peculiar to the child. We are daily learning more about the course of this development and gaining experience in interpreting our findings in the light of the potentiality of the individual.

Deviations from this optimum path are determinable by periodic observations of particular evidences of growth and development. Of importance in these criteria are the periodic gains in length and weight, the evidence of maturation and the character of the mineral reserves, as revealed in skeletal roentgenograms, the nature and extent of dental caries, as learned from mouth examinations and intra-oral roentgenograms, intelligent history taking and, perhaps most important, the observation of the child. From the last, a very workable idea of the state of nutrition, muscular tonicity and mental activity can be gained in the contact at the usual orthodontic examination.

Some of these items are included in the routine records of practicing orthodontists today. All of them are probably not necessary. It would appear, then, that, without undue demand on the time or the installation of expensive equipment, records might be kept that would reveal the failure of patients to enjoy the normal progress expected of them. In these instances, the orthodontist may solicit the aid of those practitioners of medicine who may be expected to pass intelligent judgment and give counsel.

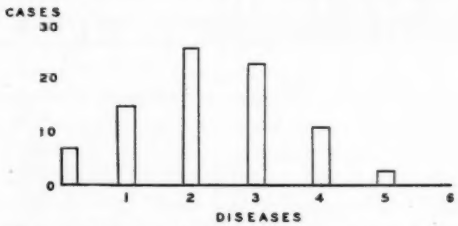


Fig. 3.—Incidence of infectious disease per child. The average per child was 2.5.

In this way, the position of the orthodontist is far more secure. He has uncovered a deficiency and has placed the problem on the shoulders of those who are, by training and experience, more qualified to diagnose and treat. And if his data are obtained carefully, he may rely with greater security on opinion based on these criteria, which are within his experience, than to risk diagnosis or hazard treatment in fields where, without extensive training, his knowledge must be superficial.

I have therefore taken from routine

clinical records of orthodontic patients data with respect to medical history, height and weight recordings, dental caries and certain notations from examination of the patient, such as mouth breathing, and attempted, with the analysis of this material, to illustrate the approach just outlined. There are also included certain correlations with respect to the several divisions of orthodontic management.

It is a study of certain features in the medical background of 100 orthodontic patients all of whom presented definite malocclusion. While the number is too small to more than suggest elements for further study, there appear to be factors that are of interest. As the material is taken from private patients, it should be of practical value to the clinician. The records were selected at random by an office assistant, the only instructions given being that they must be those of children that presented a definite deformity of occlusion which had received treatment. Cases that, for any reason, failed to include a reasonable number of important notations of data to be recorded were eliminated. In the analyses that follow, it will be noted that many of these records were not complete in every detail; which is perhaps inevitable in choosing records from private practice. They do represent a reasonably well-rounded summation of the data on the points recorded.

The average duration of observation for each patient (Fig. 1) was four and eight-tenths years, the majority of cases being observed from two to seven years. Only seven cases were observed for less than two years, and no cases for less than one year and two months. The longest period of observation was for twelve years and three months. It was believed that there was adequate opportunity in the time of observation of each patient to become acquainted with significant features of the general health of the child.

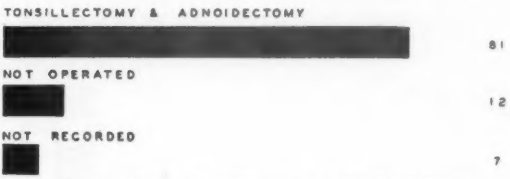


Fig. 4.—Incidence of tonsillectomy and adenoidectomy.

Fig. 5.—Analysis with respect to mouth breathing.

The age at the time of the first observation (Fig. 2) varies from 3 years and 6 months to 17 years. Most of these children when first seen were from 5½ to 13 years of age. It will be noted that there is a steplike rise from 7 to 10 years of age, again from 10 to 11, and also following the eruption of the first permanent molar, from 12 to 13. There is a slight rise at about the time of puberty.

An analysis with respect to sex showed that there were in this series fifty-two girls and forty-eight boys. It is perhaps significant that the incidence is essentially equal with regard to sex, and also, from a practical point of view, that, apparently, parents regard the correction of malocclusion in boys as important as in girls.

There is at present so great a divergence of opinion with respect to classification of malocclusion, as well as some reasonable question of its value, that I hesitate to present the tabulation of this series. Practically half of the patients fell within Class I; a little more than 25 per cent in Class II Division 1, and adout 10 per cent in Class II Division 2, with approximately one fifth of each of these two classes falling to the respective subdivision.

Turning now to the medical background of these children, we find that the incidence of infectious diseases suffered prior to their first orthodontic examination (Fig. 3) averaged two and five-tenths per child. In fifteen instances, the data were not completely recorded in the patient's history. The tabulation includes only specific infectious disease entities of a more serious character, the common cold, otitis media, bronchitis, diarrhea and the like not being included. Chronic nutritional and allergic conditions are also eliminated. The common run of childhood diseases such as measles, whoopingcough, chickenpox, mumps and scarlet fever comprise the majority of these infections. It is interesting to note that there were seven children with a record showing none of the infectious diseases. There were fifteen showing one; twenty-six, two; twenty-three, three; eleven, four, and three, five. Notwithstanding the exclusions, it is quite evident that the children of this group have less than the average incidence of the diseases considered.

An analysis of the infectious and noninfectious disease entities, with the exception of the common upper respiratory infections, otitis media, less important

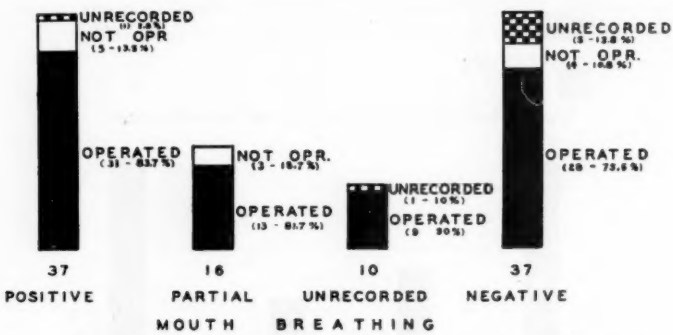


Fig. 6.—Tonsillectomy and adenoidectomy in mouth breathing.

gastro-intestinal infections and all surgical cases, other than mastoid, also suggested that these children are healthier than the average. It was interesting to note that the incidence of infectious diseases for which immunization has been developed and is in common use is extremely low. For example, there were nine cases of scarlet fever and four of diphtheria. These offer an interesting contrast to the incidence of measles, fifty-five cases; whooping-cough, forty-five, and chickenpox, forty. These figures are from the histories of eighty-seven patients, three of whom had none of the diseases listed.

The only surgical procedure routinely recorded is that of tonsillectomy and adenoidectomy (Fig. 4). The combined operation was performed at least once on eighty-one of the 100 children, twelve were not operated on and in seven the condition was not recorded. In sixty of these children undergoing tonsillectomy, the age at operation was noted, and, of this group, about 50 per cent had been operated on before the fifth year of age. There were six patients with operations recorded at 2 and seven at 3 years of age. No correlation could be established between the age at operation and its effectiveness.

The statistics on tonsil and adenoid operations suggest the analysis of these cases with respect to mouth breathing (Fig. 5). This condition was found to be recorded in ninety of the 100 patients, thirty-seven of whom were definitely mouth breathers, and an equal number were not. There were sixteen children in whom the condition existed at interrupted intervals.

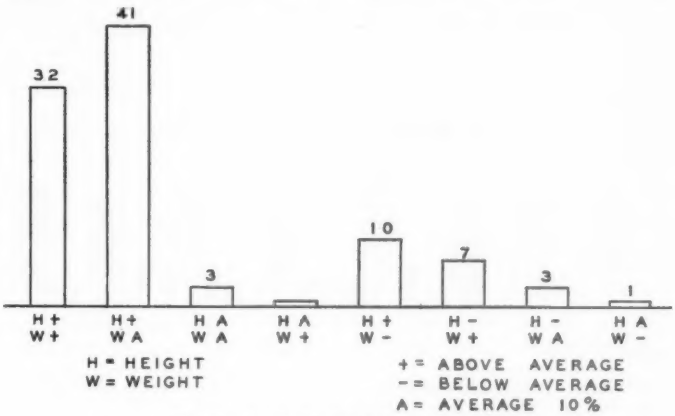


Fig. 7.—Analysis of height and weight.

If we now compare the statistics with respect to tonsillectomy and adenoidectomy and mouth breathing (Fig. 6), we find practically no correlation. Of the thirty-seven children who were definitely mouth breathers at the time of examination and in whom the practice was well established, 83.7 per cent had been operated on for the removal of tonsils and adenoids. Of the same number in whom mouth breathing was not practiced, 75.6 per cent had previously undergone operation. Of the sixteen children in whom mouth breathing was intermit-

tently practiced, 81.7 per cent had been operated on previous to examination, or practically the same percentage as that observed in cases of positive mouth breathing. This does not mean that the tonsil and adenoid operations were not indicated for the purpose of removing a focus of infection, but it does indicate that surgical procedure alone is not a satisfactory therapeutic measure from the standpoint of mouth breathing. It also illustrates a fact frequently observed clinically, that the mere establishment of the possibility of normal nasal breathing is not sufficient to insure that it will be practiced. The surgeon is here confronted with the same problem as that of the orthodontist. His first concern is to make normal function possible, and the second, which is of equal importance, to institute that practice which active treatment made possible in order to insure permanency of results.

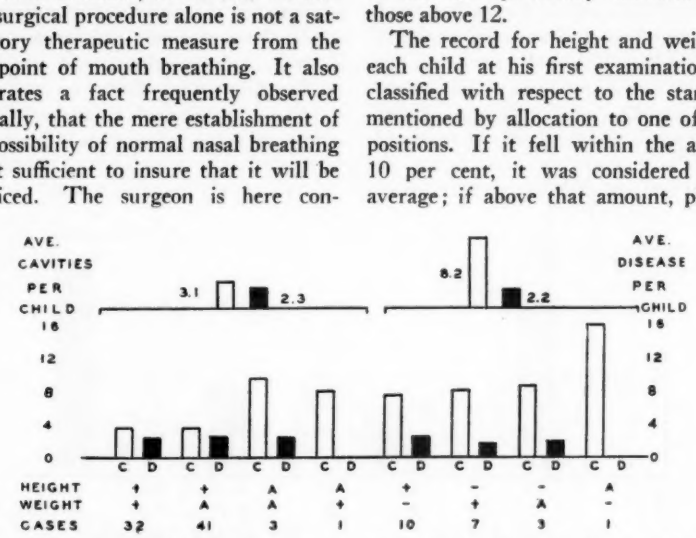

AVE. CAVITIES PER CHILD
3.1
2.3
8.2
2.2
AVE. DISEASE PER CHILD
16
12
8
4
0
C D C D C D C D C D C D C D C D
HEIGHT + + A A + - - A
WEIGHT + A A + - + A -
CASES 32 41 3 1 10 7 3 1

Fig. 8.—Height and weight and incidence of caries and other disease at first examination. *C*, caries; *D*, diseases; +, above average; *A*, one; —, below average.

Factors usually included in physical appraisement are height and weight. Records were available in ninety-eight of the 100 cases studied. At first examination, an analysis of the recorded height and weight for each child was compared with accepted standards. Standards for height were taken from Bowditch as given in the 1933 edition of the text on pediatrics by Griffith and Mitchell. The weight figures for these children were compared with the Woodbury standards for those under 5, with the Baldwin Wood for those from 5 to 12, and with Wood's table as given in the text previously mentioned for those above 12.

The record for height and weight of each child at his first examination was classified with respect to the standards mentioned by allocation to one of three positions. If it fell within the average 10 per cent, it was considered A or average; if above that amount, plus; if below, minus. From Figure 7, it will be seen that seventy-seven of the ninety-eight children were average or above with respect to both height and weight. There were no children in the group that were below for both height and weight; which again indicates that the children of the study were, with respect to this particular criterion, above average.

As many well-conducted investigations of recent years have suggested the value of the incidence of dental caries in the health appraisement of the child, the tabulation of restorations and cavities at

the first observation is included. As the records are of children who are receiving dental care, and in order to obtain a simple and reliable standard for appraising this condition, the full mouth roentgen-ray examination was used. While for purposes of statistical tabulation of caries, this method may be open to question, it is believed that it could be employed as a reasonable method for this group and is subject to no more error than that usual in mouth examinations. The records of ninety-eight patients included 385 full mouth roentgen-ray examinations, an average of four per child. In two of the cases of this study, the roentgenograms had been forwarded to practitioners outside the city, and were consequently not available. The figures include cavities and restorations observable in the roentgenograms. The detailed analyses of this portion of the study will be reported elsewhere at a later date and consequently is not included. The summary indicates an average of three and seven-tenths cavities per child at first examination. There were twenty-five children whose roentgenograms revealed no evidence of dental caries. When we recall that an examination of Chicago school children a few years ago, including 6,492 examinations, revealed an incidence of six and three-tenths cavities for children ranging in age from 3 to 10 years; an examination of 918 children in Hyde Park High School, in Chicago, conducted by a committee of the Chicago Dental Society, of which Stanley D. Tylman was chairman, reported an average of five and four-tenths cavities per child, and an examination of 114 children ranging in age from 6 to 18 years in a Highland Park, Ill., public school, examined by C. V. Nichols revealed six and seven-tenths cavities per child, it would appear that this group is less susceptible to dental caries than the average child in this region.

An interesting comparison is found to arise when we combine the figures with respect to height and weight, dental caries and the incidence of disease. (Fig. 8.) The white block indicates cavities; the black, the incidence of disease. The two are compiled separately for each classification with regard to height and weight. There was, for example, in the thirty-two children who were above average for both height and weight, an incidence of two and eight-tenths cavities per child and two and two-tenths infectious disease. From this chart, it will be observed that the incidence of caries per child increases as we approach the less favorable height and weight grouping; while that of the incidence of infectious disease remains practically constant or decreases slightly. If we combine, on the

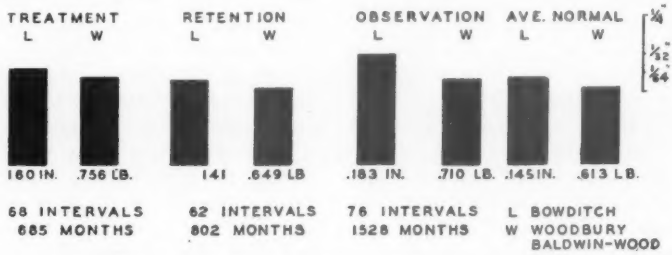


Fig. 9.—Average length and weight gains per month.

one hand, all of the children who were average or above with respect to height and weight and, on the other, those that were below in one of these respects, we find that the incidence of dental caries in the former is three and one-tenth cavities per child; while, in the latter, it is eight and two-tenths. The incidence of infectious disease varies only one tenth. From this, it would appear that, in this study, the incidence of caries is more closely related to nutrition than to extra-oral infectious disease.

Height and weight were recorded at intervals throughout the orthodontic management of these patients. The length and weight gains (Fig. 9) for the subjects of this study were summarized with respect to increases during treatment, retention and observation. In the figures that are given, only those intervals are included that correspond with less than one-month variation from the respective period of management. From Figure 9, it will be observed that in the sixty-eight intervals of treatment, comprising a total of 685 months, there was an average of 0.16 inches a month and 0.756 pounds. During the sixty-two intervals of retention, comprising 802 months, there was an average gain per month of 0.141 inches and 0.649 pounds. During seventy-six intervals of observation, totaling 1,528 months, the greatest average monthly gain in height of 0.183 inches was attained, the weight advancing at the rate of 0.701 pounds. If we compare these figures with the average monthly gain in the standards previously given, we find that, during treatment, there was an average gain in height of slightly less than one sixty-fourth inch per month greater than that experienced by the average child. During retention, the average gain per month is approximately the same; that is, within four one thousandths inch per month of that of the average child; while, during observation, the gain in length was slightly less than three sixty-fourths inch per month greater than the average. With respect to weight, in all three periods of management, there was a greater than average increase. The greatest difference is shown between the gain in length during retention and observation, less than three sixty-fourths inch per month, or less than half an inch per year. When we recall that the gains in all periods of orthodontic management are greater than those given in the average figures, recognize the possibility of error in measurement and take into account the discrepancy between the number of months considered, it is believed that there is no outstanding effect during any of the periods of management on the growth of the child. The presumable reason for the greater increase in height during observation is the greater number of intervals in this group which occur during the preadolescent height increase. Weight usually lags somewhat behind at this time. It can scarcely be said from these figures that growth is either accelerated or retarded by the application of orthodontic devices.

SUMMARY

One hundred orthodontic patients, all of whom had a definite well-recognized malocclusion and were observed for an average of four and one-half years per patient during the time of orthodontic management, were as a group less susceptible to infectious diseases, were of appreciably greater than average height and weight at the time of their first examination, showed greater gain in length and weight during orthodontic management and were less susceptible to dental caries than the average child.

Most of these children have undergone tonsillectomy and adenoidectomy, which has had little effect on the incidence of mouth breathing in the group. There is a strong suggestion that the incidence of dental caries in these children is affected by their state of nutrition, though it is not necessarily the primary etiologic factor. While there are children within the group whose malocclusion is without question related to systemic conditions primarily and others in whom there is a secondary relationship, as, for example, the group that had previously had rickets or, at the present time, are subject to a nasal allergy, it appears that malocclusion may develop in children who, according to our present criteria, are above average with respect to health.

It is extremely important to the practicing orthodontist to recognize, as he may with the means that are available to him, what children in his practice may be counted on for a normal response, in order that he may determine the particular nature of the problem presented by the smaller but important remainder. In this way he may be of greatest assistance and have the understanding that is essential for the most successful outcome of his treatment.

The taking of a comprehensive history, supplemented by questioning at subsequent intervals; the regular recording of height and weight, the recording of the incidence of dental caries and the intelligent observation of the patient are relatively simple measures which are within the ability of all practitioners; and a careful and intelligent observation of these records kept over the usual interval of orthodontic management will reveal the presence of practically all of the systemic conditions that may affect the patient. Not only will the orthodontist increase the value of his services to his patients by attending to these details, but he will also materially increase his opportunity for success in that small but critical group of cases that differentiate between the mediocre and a skilled practitioner.

30 North Michigan Avenue.

ANATOMY OF THE THROAT, MYLOHYOID REGION AND MANDIBLE IN RELATION TO RETENTION OF MANDIBULAR ARTIFICIAL DENTURES*

By HUGH W. MacMILLAN, D.D.S., M.D., F.A.C.D., Cincinnati, Ohio

THE clinical success of mandibular dentures that are extended to far greater limits than those usually employed prompts an inquiry into the anatomy of the structures supporting the extended dentures and an effort to determine the farthest edge or boundary to which they may be extended. The claim of greater stability for extended dentures alone warrants such a study. If greater stability is obtained without pathologic changes in the supporting tissues, one of the greatest advances in prosthesis has been achieved in developing the mandib-

*Read before the Section on Full Dentures at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 20, 1936.

ular denture into a physiologic appliance.

The proper approach to such a study is from the standpoint of myology, not osteology. Too many technics in dentistry, even prosthetic dentistry, have been founded on the anatomy of the dry maxillary bones. Stereotyped dissections of prepared specimens such as are usually found in the anatomic laboratories are of only slightly more value. By the use of special embalming solutions and manipulation of the tissues, specimens are produced that approach the living tissues in pliability, resiliency, normal contours

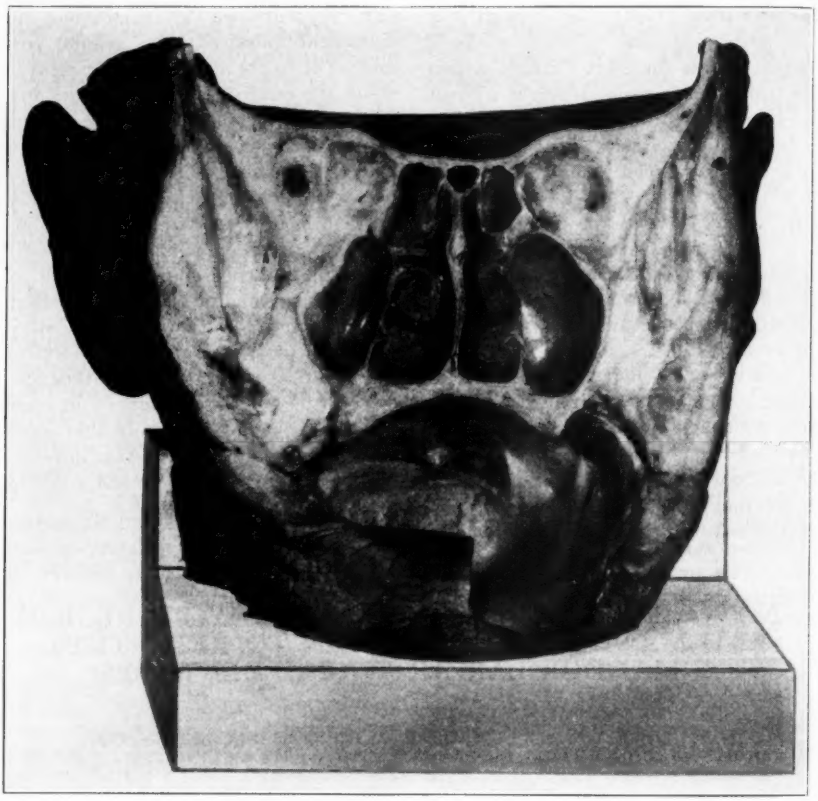


Fig. 1.—Head of cadaver mounted in block of plaster of Paris and sectioned to show relation of structures within mouth at rest. The "discovery" of the muscular partition between the sublingual space and the fauces and the pouchlike formation of the posterior portion of the sublingual space has been illuminating to prosthetists. In the living patient, when the mouth is opened wide for examination, the structures forming the posterior boundary of the sublingual space are hidden from the examiner by the tension of the muscle fibers of the anterior palatine arch and can be demonstrated only with difficulty.

and correct relations. The method *par excellence* in studying and teaching relations involves the use of anatomic reconstructions from actual dissections showing the relations of the muscles and principal structures according to scale.

As usually seen in the cadaver, the teeth of the opposing series are slightly apart—the position of rest in the living. It is important that this fact be recognized when clinical applications involving anatomic mechanisms are made from dissections. It is interesting to contemplate that, in the patient, the normal relations of the parts inside the mouth proper cannot be observed by the examiner. As soon as the mouth is opened, the parts are put on tension, muscles have come into play and everything contained within the mouth assumes a relationship far different from that of the structures at rest or during functional excursions. These abnormal relationships are too often obtained in taking impressions. The resulting prostheses are constructed over casts that do not portray the relationships of rest or function or the happy medium.

Fig. 2.—Mandibular denture and cast made by G. F. Henderson, of Chicago. The halves of the fractured denture show more clearly the exact dimensions and contour of the lingual flanges.

The anatomic specimen shown in Figure 1 is a fair example of what can be done to obtain more accurate information regarding the relation of the soft

tissues concerned in the construction, implacement and successful use of a mandibular denture when the tissues are at rest. The specimen has been prepared in such a manner that the physical characteristics of living tissues are preserved very satisfactorily. In the photograph, the cheek and tongue have been held aside to show more clearly the mandibular alveolar ridge, the buccal fornix, the posterior part of the sublingual space, the glossopalatine arch and the pterygomandibular fold—all of which must be evaluated in rational prosthesis.

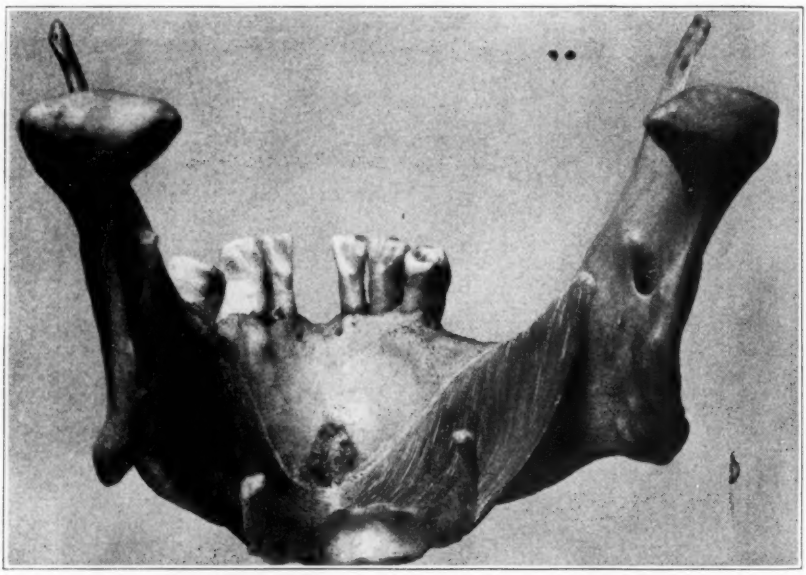


Fig. 3.—Reconstruction of mylohyoid muscle from actual specimen. The vertical fibers of posterior free edge of the muscle and the space between the muscle and the body of the mandible below the mylohyoid "line" are to be noted.

From the start, it must be realized that the textbook descriptions of the muscles of the normal mandible that contains teeth do not apply to the muscles of the edentulous mandible. It is imperative that this be recognized, as the foundation of the mandibular full denture is concerned for the most part with muscle tissue. In the normal mandible containing teeth, the buccinator muscle opposite the first and second molar regions is attached to the alveolar process on a line with the middle third of the roots of these teeth. After the teeth have been extracted and absorption has occurred, the attachment of the buccinator muscle may extend nearly to the crest of the ridge, so that, instead of resting on mucoperiosteum and bone, as is usually supposed, the buccal flange of the denture is separated from the bone by the interposition of the buccinator muscle. This muscle, being in a state of constant change of contraction and relaxation during functional movements of the mandible, does not afford a stable foundation, to say

the least. Similarly, the textbook description of the mylohyoid muscle does not apply to the edentulous case. The mylohyoid line represents roughly only the lower border of the mylohyoid muscle attachment. The fibers of attachment may extend up over the inner surface of the mandible above the mylohyoid line for several millimeters. This is of great practical importance when, in the edentulous case, the muscle is found extending up as far as the crest of the ridge. The

Fig. 4.—Reconstruction of edentulous mandible, temporal muscle and mylohyoid muscle, inner surface, side view. The vertical fibers of the posterior portion of the mylohyoid muscle are the direct antagonists of the temporal muscle.

lingual flange of the mandibular denture is concerned far more with the mylohyoid muscle than with the mucoperiosteum or the bone. In case of considerable absorption, there is often only a narrow space along the crest of the ridge which is devoid of muscle tissue, and cases may be observed in which buccinator muscle and mylohyoid muscle meet in the middle of that part of the bone which dentists are pleased to call "the center of the ridge."

The textbook descriptions and illustrations of the attachment of the temporal muscle and tendon are also confusing. Fibers of the temporal muscle and the tendon are attached to the bone forming the retromolar triangle. When the denture is extended over this region, as in the Tuller-Fornet technic (as yet unpublished), it is well to recall that it rests successively on mucous and submucous tissue with its glands, buccinator muscle, temporal muscle and tendon, fibers from the masseter muscle and, finally, bone.

The upper posterior portion of the lingual flange passes around the pterygomandibular fold, which is the rounded corner of the mouth proper, immediately anterior to the fauces. This fold indicates the pterygomandibular raphe, which gives attachment to the buccinator muscle and superior constrictor muscle of the pharynx. The lower point of attachment of the pterygomandibular ligament at the posterior extremity of the mylohyoid ridge is of clinical importance. Inferior and posterior to this point are located those fibers of the superior constrictor muscle that pass to the tongue.

Immediately behind the pterygomandibular fold is the glossopalatine arch, or the anterior pillar of the fauces, which extends from the soft palate to the side of the tongue. The reflections of the mucous membrane over the anterior aspect of the glossopalatine muscle, the side of the tongue, the lingual portion of the superior constrictor of the pharynx, the mylohyoid region and the floor of the mouth define the posterior limits of the sublingual space, a region of paramount importance to the prosthodontist.

The extension of the mandibular denture into the sublingual space has been used for a number of years with great clinical success by George H. Henderson, of Chicago.[1] A denture constructed and worn by Henderson is shown in Figure 2. The fact that this denture and dentures similarly constructed have been successfully worn is a criterion of their practicability. It would seem that the chief reason for their successful use was an accurate impression, obtained in such a manner that the completed denture was in harmony with the functional movements of the mylohyoid muscle, the superior constrictor muscle of the pharynx, the glossopalatine muscle and the muscles of the tongue, as well as being tolerated equally well by the tissues at rest. Other structures lying immediately under the mucous membrane of the sublingual space must also be recognized; i.e., the deep portion of the submaxillary gland, the sublingual gland, the lingual nerve and salivary ducts.

The mere enumeration of the various structures concerned in a mandibular impression makes such a procedure appear formidable, but it should be kept in mind that such impressions have been made successfully. Suffice it to say that an impression technic must be developed different from that usually employed. The difficulties in obtaining an impression of this region in the sectioned heads of cadavers are insignificant in comparison to the difficulties presented in obtaining impressions in living subjects. The impression technic to be employed is not in the scope of this paper; but, to insure success, it seems that a special tray must be made of rigid material, such as vulcanite, from a preliminary impression that registers as accurately as possible the depth of the sublingual space, and the contour of the remaining tissues to be covered as well; and that the peripheral limits of the vulcanite impression tray should be trimmed to a close approx-

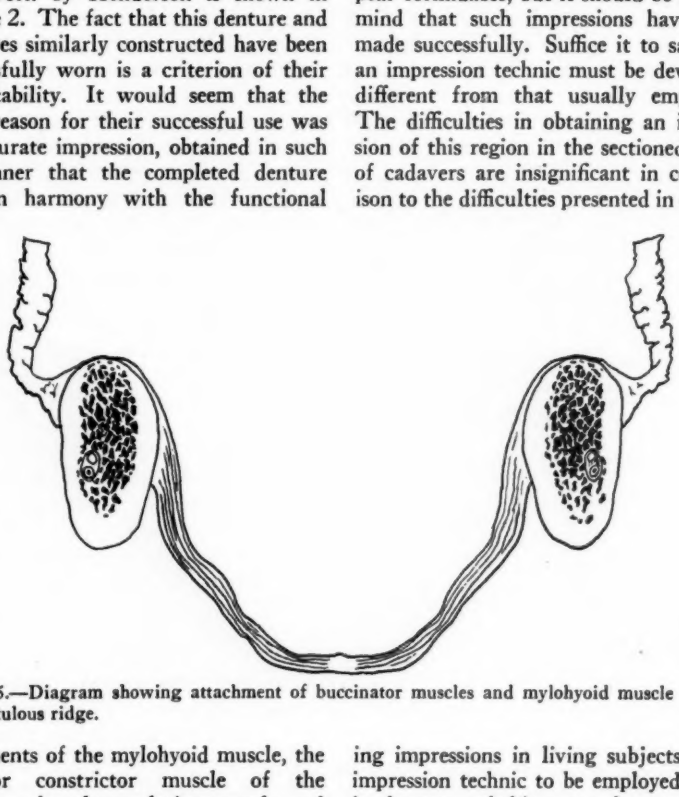


Fig. 5.—Diagram showing attachment of buccinator muscles and mylohyoid muscle to crest of edentulous ridge.

1. Henderson, G. H.: Personal communication to the author.

imation of the periphery of the completed denture. The materials and methods used in completing or correcting the final impression belong to the field of prosthodontia.

The mandibular artificial denture rests only in part on bone, which is immediately covered by mucoperiosteum. The muscles on which it rests and which form its periphery determine chiefly the final conformation of the denture. The muscles concerned with the buccal periphery have received considerable attention in prosthetic literature. The anterior attachment of the genioglossus registers definitely the limit of the denture in this region. The mylohyoid muscle has not received sufficient emphasis in the literature and does not record itself so definitely in the impression.

The Mylohyoideus, flat and triangular, is situated immediately above the anterior belly of the Digastricus, and forms, with its fellow of the opposite side, a muscular floor for the cavity of the mouth. It arises from the whole length of the mylohyoid line of the mandible, extending from the symphysis in front to the last molar tooth behind. The posterior fibers pass medialward and slightly downward, to be inserted into the body of the hyoid bone. The middle and anterior fibers are inserted into a median fibrous raphe extending from the symphysis menti to the hyoid bone, where they join at an angle with the fibers of the opposite muscle. This median raphe is sometimes wanting, the fibers of the two muscles are then continuous.[2]

Owing to the obliquity of its line of origin the mylohyoid muscle, passing to the body of the hyoid, has its posterior fibers and "free edge" more vertical than horizontal, whereas its front fibers are horizontal.[3]

2. Gray, Henry: Anatomy of Human Body, Philadelphia: Lea and Febiger, Ed. 22, p. 390.

3. Frazer, J. E.: Anatomy of Human Skeleton, Ed. 3, London: J. & A. Churchhill, 1933, p. 260.

The attachment of the genioglossus muscle, "the front fibers" of the mylohyoid muscle and the sublingual gland accounts for the narrowness of the lingual flange anteriorly. Immediately behind the sublingual gland, the fibers become more oblique and approach the vertical at the posterior free margin of the muscle, the characteristic deepening of the lingual flange of the denture posteriorly resulting. While the deep part of the submaxillary gland, the submaxillary duct and the lingual nerve are directly beneath the mucous membrane covering the posterior part of the sublingual space, the chief determinants of the contour of the inner surface of the lingual flange are the vertical fibers of the mylohyoid muscle. Any impression material that forces the mylohyoid muscle and sublingual tissues to follow the contour of the mandible inferiorly to the mylohyoid ridge is ill-advised, because a denture made from such an impression would traumatize the tissues every time the mouth was opened.

This traumatism is explained by the functional action of the posterior part of the mylohyoid muscle. The vertical fibers that are attached to the hyoid bone are parallel to and are the direct antagonists of the temporal muscle. The fibers located in the region of the posterior border pass upward along the inner surface of the ramus and are continuous with the temporal tendon. An impression technic must be employed that will lend itself to recording accurately the position assumed by these tissues during function.

CONCLUSIONS

1. The clinical success of mandibular dentures that are extended to cover much larger surface than is usually the case calls for a standardization of the procedure.

2. Any method that increases stabilization of the mandibular denture should be developed to its greatest efficiency.

3. The textbook description of the muscles attached to the mandible does not apply to the edentulous mandible.

4. For uniform results, accurate knowledge of the relations of the tissues supporting the denture during function and at the rest position is desirable.

5. The posterior fibers of the mylohyoid muscle are the direct antagonists of the temporal muscle.

6. Stabilization is one of the chief factors in producing prosthetic appliances that will afford physiologic stimulation to the supporting structures.

1004 Union Central Building.

DIET AS A FACTOR IN HEALING*

By FREDERICK F. MOLT, D.D.S., Chicago, Ill.

AN increasingly deep interest has been manifested, during the last two decades, in calcium and phosphorus metabolism, chiefly in relation to various pathologic conditions, but incidentally in the matter of healing.

A most comprehensive résumé of contemporary literature on this subject is that of Cantarow,[1] who digests contributions included in a bibliography covering twenty pages. It is interesting to note that he quotes Bertram[2] (1878) and Albu and Neuberg[3] (1906) as investigators antedating the period mentioned here.

The consensus gives several factors in the absorption of calcium either from food or from calcium compounds: "The hydrogen-ion concentration within the intestine, the relative proportion of other substances in the diet and vitamin D." The "intimate relationship between the phosphorus and the calcium metabolism" is also stressed, as is the influence of the parathyroid hormone. Here again, much importance is attached to vitamin D: "The increase of both phosphorus and calcium brought about by its administration is well known." Hess[4] attributes the "main activity" of vitamin D to the "intermediary metabolism," and Cantarow states that a "factor which is necessary for the normal calcification of bones is supplied by the ingestion of foods containing vitamin D, foods previously inert which have been activated by irradiation and irradiated ergosterol as well as by exposure of the body to ultraviolet radiation, artificial and solar." Cantarow also remarks on a divergence of opinion with regard to the mechanism by which the parathyroid hormone exerts its influence. Certain persons believe that it acts directly on calcium metabolism; others that it affects pri-

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 7, 1935.

1. Cantoraw, Abraham: Calcium Metabolism and Calcium Therapy, Ed. 2, 1933, Philadelphia: Lea & Febiger, 1931. (Foreword by H. A. Dare.)

2. Bertram, J.: Ztschr. f. Biol., Vol. 14, 1878.

3. Albu, A., and Neuberg, K.: Phys. u. Path. d. Mineralstoffwechsels, 1906.

4. Hess, A. F.: Rickets, Osteomalacia and Tetany, Philadelphia: Lea and Febiger, 1929.

marily the metabolism of phosphorus, and that the calcium is affected secondarily. In investigatory work, a parathyroid deficiency is cared for by the injection of parathyroid extract. Collip called this preparation "parathormone."

These findings have, of course, had such general acceptance that ultraviolet irradiation is routine, and we have myriads of "activated" products, from milk to breakfast cereal. The chief objective has been to cure or avoid such aberrations from health as rickets and tetany, in which prolonged calcium and phosphorus deficiency is the salient factor. More recently, the possible or probable relationship of such deficiencies to dental disease and to osteomalacia of the jaws has been a subject of discussion. That they are involved in delayed union or nonunion of fractures, either of the long bones or of the jaws, has been assumed for some time, although Cantarow questions this possibility.

It is noteworthy that, in this consensus, no mention is made of vitamin C as an important influence in calcification, although Holst and Frölich,[5] in 1906, reported bone changes in guinea-pigs which were permitted to "develop a condition comparable in every respect with human scurvy." Striking changes in the teeth of scorbutic guinea-pigs have been demonstrated by Howe and corroborated by Hanke. Israel and Frankel,[6] in a contribution on the influence of avitaminosis on the healing of bone fractures, state that, in a properly nourished guinea-pig, there is a rounding of the broken edges in eight days, periosteal callus in fourteen days and complete consolidation in from five to six weeks; whereas, there are no signs at all of repair in three weeks in an animal whose diet is free from vitamin C. Normal repair can be started at any time by adding vitamin C to the diet. Pigs kept in a state of chronic scurvy develop a condition resembling pseudo-arthrosis in man. The fracture area is, in time, covered with a loose callus, but the broken bones do not knit. A series of broken femurs were allowed to undergo repair on a normal diet for fourteen days and vitamin C was then removed from the diet. The repair process proceeded for four weeks, at which time the animals were on the point of death from scurvy. They were revived at this time by feeding small amounts of carrots, but kept in a state of chronic scurvy, as a result of which the newly formed callus atrophied and was decalcified, becoming an easily broken shell.

Hanke[7] noted, in his work on vitamin C and its relation to changes in teeth and their supporting structures, the common occurrence of fractures in scorbutic pigs. Even though these fractured bones were properly splinted, there was no healing as long as the diet was deficient in vitamin C; but when this element was restored in proper amounts, satisfactory healing took place. As there were no other deficiencies, the relationship seems obvious.

Curtis[8] observed a group of unhealed fractures of the long bones in hospital patients on routine hospital diet. The addition of an ample amount of vitamin C brought about uneventful healing. A similar group of unhealed jaw fractures in the same hospital, and with the patients on a similar diet, were stimulated to healing by the addition of a quart of orange juice a day.

5. Holst and Frölich: Ztschr. Hyg. u. Infectious-krankh., 1912.

6. Israel, A., and Frankel, R.: Klin. Wchnschr., 5:94 (Jan. 15) 1926.

7. Hanke, M. T.: Personal communications to author.

8. Curtis, G.: Personal communications to author.

Practically the same observations have been made in the treatment of several severe cases of osteomyelitis in which the cessation of bone destruction and the beginning of recovery was apparently in great measure associated with diet correction. In one extremely severe case, the patient recovered with no sequestration whatever.

Graf has reported a case of osteomyelitis of the humerus following a shrapnel wound received in the World War. The patient had been operated on seven times with no cessation of the infection. He was 6 feet 2 inches tall and weighed 140 pounds. His diet consisted almost entirely of meat, bread and potatoes. Graf reoperated and immediately so changed the diet that it contained a superabundance of vitamin D (cod liver oil) and vitamin C (orange juice) as well as eggs, milk, leafy vegetables and fresh fruit. Complete recovery in two months, with an increase in weight and great improvement in health, is attributed by Dr. Graf chiefly to the change in diet.

Dry socket, so-called, has been a vexing problem to the dental profession for years. Many theories have been offered as to its causation, chiefly (1) the use of a local anesthetic, (2) the washing out of the blood clot and (3) the introduction of infection into the wound. None of these seems completely tenable, as (1) such a condition is quite as frequently found after extractions under a general anesthetic; (2) "dry socket" occurs when no rinsing has been done and where a firm and satisfactory blood clot has been formed, but later disintegrated, and (3) it frequently occurs where the utmost precautions have been observed as to asepsis in operating. True, smears from the walls of such a socket show a multiplicity of organisms, with the fusiform bacillus and spirochete of Vincent in great numbers, but these organisms are known to be great scavengers and may be found in equally great numbers on a tonsillectomized area or any exposed incised surface in any mouth a day or two after operation.

As the mechanics of bone deposition in tooth sockets are identical with those of fracture healing or redeposition in osteomyelitis, it seems quite probable that, at least in a large proportion of cases, the same basic contributory factor is present.

We have been going through a period in which the most absurd dietary restrictions, offered by just about anyone, no matter what his qualifications, have been accepted and utilized. Reducing diets have been responsible for the complete loss of health in a multitude of cases. Diets have been prescribed for patients suffering from various diseases, such as gastric ulcer, colitis and cholecystitis, with no regard for any part of the body other than that directly concerned.

The majority of patients for extraction are taken, we might say, literally "off the street." They come in because they have toothache or because, for some reason or other, and possibly without the advice of a physician, they have decided that certain teeth should be removed. A satisfactory and complete evaluation of the patient's physical condition is, under such circumstances, hardly possible. An undernourished patient is a poor risk for any operation, and that applies quite as definitely to minor as to major surgery. Undernourishment may be present, of course, for reasons other than deficiencies of diet, but the most impressive of all the cases under my observation have been the dietary deficiency cases.

Gardner[9] points out that a patient anticipating a cholecystectomy or like op-

9. Gardner, B. S.: D. Cosmos, 76:945 (Sept.) 1934; Prosthodontist's Interest in Mineralization and Demineralization of Bone, J.A.D.A., 22:995 (June) 1935.

eration is usually kept under observation and, as adequately as possible, prepared for the operative work. On the basis of safety for the patient, it would be advantageous if all extraction cases, particularly those calling for extensive or severe operation, might be handled in like manner. Only a small proportion are, and it does not, at the present time, seem feasible to increase that proportion.

The susceptibility of certain patients to the occurrence of dry socket, no matter how carefully the operative technic was carried through, whether the wound had been closed by suturing or left completely open, as well as its almost invariable occurrence in the same patients, no matter how long the interval between operations, called for questioning as to diet. The frequency with which these patients reported that because of some ailment, real or imaginary, they could not or would not take orange juice or eat any fresh fruits or vegetables was striking. Determination of blood phosphates and calcium showed a normal level. On my own responsibility or with the physician's sanction, frequently a very grudging assent, these patients were given a diet excessive in vitamin C, but otherwise balanced, with immediate and eminently satisfactory healing results. It has become routine, therefore, to suggest the addition of from a pint to a quart of orange juice daily as a postextraction measure, and dry sockets are of very infrequent occurrence.

The process of bone formation in healing may be sketched briefly as follows: Osteoblasts collect in an area under repair (as in bone construction) and exude a viscid gelatinous fluid, which normally congeals to form collagen. Lime salts deposit in the collagen to form a dense calcified mass. Osteoblasts exude this viscid fluid even though the diet is inadequate, but this does not congeal to form collagen unless vitamin C is present in adequate amounts, and possibly vitamin A as well. Calcification of the collagen requires vitamin D and, of course, calcium and phosphate.

Calcification, it is to be observed, is only one step in this process, and no matter how adequate the amounts of vitamin D, parathormone or lime salts may be, unless this viscid liquid congeals, and this cannot occur without vitamin C, we do not have satisfactory repair.

It is most desirable to bolster the diet in regard to calcium and phosphate, even though we know, as with the pregnant woman, the requirements will be met, if necessary, by robbing other portions of the body. So the addition of eggnogs fortified with metabolizable calcium, such as calcium acid phosphate (dicalcium phosphate), adequate amounts of orange juice and cod liver oil, haliver oil or ergosterol, is important. The process may be likened to the building of a structure in which the calcium and phosphate represent the building stones, while the vitamin elements C and D act as cementing substance.

What diet the patient may have set before him and what he eats, as suggested by Gardner, may be utterly at variance. It is important to know, therefore, that the patient not only receives his diet but also ingests it. Cantarow remarks on "an extraordinary variation in the calcium content of the diet of various nations," quoting Tigerstedt[10] on the diet of the Finns, which contains from 2 to 6 gm. of calcium oxide daily, owing chiefly to their large milk consumption. Sherman[11] finds that the

10. Tigerstedt, R.: Skan. Arch. Physiol., Vol. 24, 1910.

11. Sherman, H. C.; Rose, A. R., and Rose, M. S.: J. Biol. Chem., 44:21 (Oct.) 1920. Sherman, H. C., and Hawley, E.: J. Biol. Chem., 53:375 (Aug.) 1922.

average American diet contains 0.45 gm., which, considering that 1 gm. represents the approximate daily requirement, is quite definitely insufficient. He attributes this to the low milk and dairy product content of the average dietary and recommends a diet that contains at least 1 gm. of calcium for every hundred grams of protein.

Just how much of vitamins C and D constitute an adequate intake has been estimated. Three teaspoonfuls of cod liver oil appears to supply sufficient vitamin D to prevent or cure rickets as well as enough vitamin A to promote normal growth. This dosage represents about 900 U.S.P.X. units of vitamin D and 6,000 of vitamin A.[12]

Vitamin C has been isolated from various sources as a pure chemical compound. Three ounces of orange juice contains about 50 mg. of vitamin C, enough to prevent symptoms of frank scurvy in an adult. Hanke and his collaborators[13] found that this amount has no demonstrable effect on dental disorders. Eight ounces of orange juice (130 mg. of vitamin C) was found to overcome gingivitis and retard dental caries in approximately 50 per cent of cases tested. A pint of orange juice (250 mg. of vitamin C) obtains the most certain results and may be considered the average daily requirement.

It is logical to assume that the same conditions that govern the deposition of bone in children may also determine calcification in adult bone. It is likely, therefore, that we may eventually be able to help both the prosthodontist and the patient who, with a distinctly unfavorable osseous formation, is confronted by an inevitable resort to dentures. There is an astoundingly vast field for research in the subject of calcium metabolism. Our profession is in a position to recognize changes in the mouth before they are manifested in other parts of the body. Either by ourselves or in cooperation with the medical profession, we are in duty bound to make the indicated inquiries and to correct unscientific dietaries.

A recitation of case histories here would be of little interest and would probably not be convincing. This situation can be studied much more satisfactorily in a clinic or other institution, where a much larger group can be observed than in any private practice. Aside from the fracture cases, the cases that can be mustered do not exceed twenty-five over a three-year period. The similarity of findings, as well as results, suffice to convince me that the subject is worthy of consideration and of much more scientific investigation. I present it on that basis alone.

SUMMARY

1. Dietary deficiencies are common. Determination of the blood calcium and phosphate is not significant and the presence of an avitaminosis is not necessarily apparent when the patient first is seen.

2. There is sufficient analogy between the healing of fractures and that of tooth sockets to assume that conditions which inhibit one may have an equal bearing on the other.

3. Vitamin C, although overlooked by a large proportion of investigators, is apparently quite as important a factor in healing as vitamin D.

4. It would be distinctly advantageous for both patient and operator if the patient's healing ability could be predetermined.

5. The mouth may be considered an index of general systemic conditions. To recognize and call attention to apparent diet deficiencies, and to correct them is a professional obligation.

25 East Washington Street.

12. Committee Report, J.A.M.A., 102, 1934.

13. Hanke, M. T., et al.: D. Cosmos, 75: 635 (July), 739 (Aug.), 933 (Oct.) 1933.

TAKING OF REGISTRATIONS FOR SECURING CENTRIC JAW RELATION*

By FINIS MARLIN HIGHT, D.D.S., F.A.C.D., Houston, Texas

As far as comfort and efficient service to the patient are concerned, the registration of centric jaw relation depends on the establishment of a workable vertical opening or distance between the jaws.[1] Changes occur in the vertical relation of the natural denture on account of the loss or wear of the teeth. Because of these changes, the correct vertical opening in edentulous cases is a debatable question. It is believed by many that this relation, changing as it does, cannot be restored to the original without discomfort and loss of efficiency of the artificial dentures.

If the vertical relation has not been lost by the extraction of the teeth, measurements should be made before the teeth are removed and, if the esthetic values are satisfactory, the natural vertical relation should be reproduced in the artificial dentures. If a close proximity of the chin to the nose when the teeth are in contact produces an unsatisfactory appearance, the dimension of the vertical relation should be increased only to the degree that makes the esthetic values acceptable.

With the vertical relation established, it is possible to record the correct centric relation accurately and scientifically by means of the gothic arch tracer. Practically all research workers who have studied jaw movements in relation to articulators have been forced to use the gothic arch tracing to establish the centric jaw position as a starting point.

Tooth relations should not be confused with jaw relations. Central occlusion refers to the harmonious interrelation of opposing teeth. Centric relation is a jaw position.

In the construction of either complete or partial dentures in which opposing cuspal relations have been lost, centric jaw relation must be recorded before it is possible to establish central occlusion. Therefore, centric relation indirectly becomes a tooth relation only after the teeth have been arranged in accordance with the recorded centric jaw relation. This statement implies that the two must be in harmony.

What is centric jaw relation? Is it just a comfortable position of the mandible, or is it a positive position that can be accurately determined? It is a positive position. It is that position with a given vertical opening at which the heads of the condyles are in their most retruded position in the glenoid fossae from which the mandible can make free lateral movements. The majority of dentists easily recognize gross errors in the registration of centric jaw relation. By far the majority of such errors are of a protrusive nature. A careful study of several hundred artificial dentures over a period of many years has revealed that, in the ma-

*Read before the Section on Full Denture Prosthesis at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

1. Niswonger, N. E.: Rest Position of the Mandible, J.A.D.A., 21:1572 (Sept.) 1934.

jority of cases, "true centric" was not present. These inaccuracies, however slight, if of a protrusive character, cause considerable annoyance to the patient, because the sliding contacts of the cusps that result cause the constant tendency to pull the mandible forward, while the muscles and proper position of the condyles have the tendency to carry the mandible backward to true centric position. The same slight errors may exist in a lateral position; that is, "true centric" may be slightly to the right or left of the recorded position. The sliding contacts of the cusps have the tendency to pull the mandible into the recorded position; whereas, the "muscle position" tends to pull the mandible into the natural or true centric position. The patient may acquire unsightly facial habits if these antagonisms are not overcome.

With the knowledge that centric jaw relation is the most retruded position of the heads of the condyles in the fossae from which movement may be started, it naturally follows that the heads of the condyles have assumed a definite position in the glenoid fossae, and that they will always go back to this position. Therefore, with this definite starting point, it is possible to choose a scientific method to establish true centric relation or to prove that true centric relation has not been recorded.

Many years ago, Gysi gave to the profession in this country a method for making the gothic arch tracing. So far, no procedure that is superior to this scientific method for the registration of centric relation has been advocated. I have designed a device to make the gothic arch tracing that places the tracing in full view of the operator and, in this manner, increases the dimensional ratio to such an extent that the recording is much larger. This method is scientific because it accurately registers the retruded position of the condyles in the glenoid fossae. If they are not in this position, a definite, sharp apex of a triangle will not be produced; nor will the patient be able to move the mandible laterally and retrace the definite markings that produced the definite, sharp apex. If the patient is of the type that can move the mandible into a more retruded position, no tracing will result, because the mandible must move forward before the tracings can be started.

It is apparent that this method or some similar method must be used if this positive position of the head of the condyles in the glenoid fossae is to be recorded.

Extreme lateral positions of the mandible to the right and left are just as definite as the centric position of the mandible. This can be demonstrated by the gothic arch tracing. A gothic arch tracing with a definite point or apex at the extreme lateral positions, right or left, can be produced, provided the mandible is carried as far forward as possible, and then moved to the lateral positions.

If a protruded position of the lower jaw is accepted as the correct centric relation and the denture is mounted on the articulator in this position, it will be observed that the articulator cannot move into the correct lateral positions. If the centric jaw relation has a protrusive error of 1 mm., it will be noted that when the mandible seeks its true centric position, the teeth will make contact only on the second molars, a space remaining between the others. This space is increased or decreased by the curve of Spee.

The importance of the establishment of the proper opening axis should be discussed in relation to centric jaw position. The research work of McCollum and associates[2] proves that the opening, or

2. McCollum, B. B., et al.: Texas D. J., 52 (Dec.) 1934.

hinge axis, can be definitely located, but it requires a facebow capable of minute adjustments. The facebow that can be purchased commercially serves a useful purpose in transferring the casts to the articulator, but will not secure the correct hinge axis. This can be secured only by a facebow of the McCollum type.

While this discussion has had for its main object, as the title would indicate, the consideration of the centric jaw relation, its recording and registration, it must not be presumed that, even after it is once correctly recorded and established, it cannot be lost in the construction of the dentures. After the centric jaw relation is established, the correct arrangement of the teeth in central occlusion is necessary.

Though centric jaw relation has been recorded and registered properly and the teeth arranged satisfactorily, conditions beyond the operator's control may cause a loss of the centric jaw relation. Such conditions as the dimensional changes that occur during the vulcanization or curing process of the denture bases, or the change in the relation of the teeth because of these dimensional changes, may produce a loss of the vertical relation.

Carelessness in the handling of laboratory equipment may account also for the introduction of errors in the final laboratory processes. Worn flask guides, battered edges of the flasks, worn-out flask clamps, etc., can account for inaccuracy in the seating of the flask parts or a slight opening of the flask that causes a loss of the correct relation of the cast to the teeth as a whole. The errors produced by these conditions can be corrected, as far as the upper denture is concerned, by grooving the cast and remounting it to its original position on the articulator before removing the denture from the cast after curing or pressing. The lower bicuspids and molars that are still in wax are then rearranged. The errors in the processing of the lower denture will be found to be very slight compared to those arising in the processing of the upper denture, because the flask parts are brought together in a vertical direction. This is not true of the upper denture because the anterior ridge tends to force the flask to close in the anterior region first. It will not be necessary to grind the occlusal surfaces of the teeth excessively in order to reestablish true centric relation if this procedure is followed. If the true centric relation is lost when the upper and lower dentures are processed simultaneously, it will be difficult to reestablish true centric relation. In many cases, excessive grinding of the teeth will be necessary. This will cause a loss in the vertical opening and the correct relation of the upper teeth to the lower teeth.

Patients who have been without dentures or who have been wearing dentures in an incorrect centric relation will have difficulty in making the movements of the mandible that will produce the correct gothic arch tracing. If these patients are dismissed for twenty-four hours with instructions to exercise the muscles of mastication by moving the mandible from side to side and backward and forward several times during this period, a correct tracing can be obtained the following day with very little effort.

PROCEDURE

The following steps are the order of procedure that I follow in recording the centric relation.

Step 1.—The cast is rubbed with soapstone powder. Baseplates are adapted to approximate closely all tissue-bearing surfaces, except in undercut areas. They are reinforced with steel wire or nails.

Step 2.—Occlusal rims are formed from impression compound. A flat occlu-

sal plane is made rather than one with a curved surface.

Step 3.—The predetermined vertical relation is established by placing the upper baseplate, with occlusal rims attached, in position. The occlusal rim attached to the lower baseplate is heated with dry heat and placed in position, and the patient is asked to close.

Step 4.—The gothic arch tracing device is attached to the buccal and labial surfaces of each rim. A lumberman's pencil is used to blacken the surface of the lower tracing plate.

Step 5.—The upper and lower baseplates are placed in position and the patient is instructed to relax the muscles and close the mouth. At the same time, the operator holds the lower rim in position with the forefingers of both hands. The patient is instructed to move the mandible forward and backward without separating the rims. When the mandible seems to be in its most retruded position, the patient is instructed to move the mandible to either the right or left lateral position as far as possible and then open the mouth. This procedure is repeated for the opposite side. These combined movements will produce a gothic arch tracing with a sharp apex, provided the patient started the lateral movements from the retruded position.

Step 6.—The two rims are removed from the mouth and two grooves cut on the upper occlusal rim in the region of the second bicuspid and first molar on each side, after which they are lubricated. Additional impression compound is traced on the lower rim in the second bicuspid and first molar region. The upper baseplate is placed in position with a small amount of adhesive powder. The additional compound that was traced on the lower rim is heated and the lower baseplate is placed in position. It is held with the forefingers of both hands. The patient is instructed to relax the muscles and close with very little pressure. The pin must be in the apex of the tracing. The baseplates are removed from the mouth after the impression compound is chilled. The rims should lock together with a slight space in the anterior region and distad from the grooves. This space is important because it indicates that an equal pressure or contact on each side has been produced. The baseplates are placed in position on the casts. The casts are mounted on the articulator by placing the facebow prong above the upper marker or by removing the marker.

THE DENTIST'S RESPONSIBILITY TO THE CARDIAC PATIENT*

By H. N. BOYNE, M.D., D.D.S., M.S., Omaha, Nebr.

HEART disease has become the leading cause of death in the United States.[1] Statistics show that an increasing number of persons are developing some form of cardiac embarrassment each year. Likewise the dentist has a greater number of these patients coming to him for dental work. In these cases, the capacity of the heart, which carries on one of the vital functions of life, is impaired, and we may encounter difficulties or even death while caring for them. Sudden death is not uncommon in patients suffering from the graver forms of heart disease, because they are relatively intolerant of septic poisoning and exhaustion. I shall endeavor to portray the outward manifestations whereby the dentist may recognize these disturbances, and present a few suggestions for the management of these cases.

The term "cardiac failure" signifies the inability of the heart to discharge its contents adequately, the circulation of the blood through the body being impaired as a result. Cardiac failure may be the result of one of two definite conditions: the weakness of the heart beat or an increased resistance to its discharge; or it may be a combination of the two. If some part of the heart is diseased, such as the valves, muscle or pericardium, its power will be diminished and the beat weaker than normal. Naturally, it will not be able to force the normal supply of blood into circulation. Again, if the heart has to force the blood onward in the presence of an increased pressure, as in hypertension, or blocking or stenosis of an outgoing vessel, such as the aorta, it will be impossible for it to send the normal amount of blood into the arteries to supply the tissues with food and oxygen.

How can a dentist recognize cardiac failure in a patient? A brief medical history taken in examining the mouth may reveal cardiac failure when the dentist least expects it. This examination also tends to have a good psychologic effect. The patient feels that the dentist not only understands his work but is also taking a personal interest in the case.

Ask the patient when he had his last physical examination, and whether the physician said anything about his heart or lungs at that time. Ask him whether he becomes short of breath on walking upstairs. The most valuable indication of the heart's essential soundness is its power to engage fully in its work without complaint.[2] Breathlessness on exertion is one of the first signs of a complaining heart. The tissues receive oxygen and give off carbon dioxide by means of the circulation. During exercise or on exer-

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 5, 1935.

1. Stone, C. T.: Mortality of Heart Disease, J.A.M.A., 103:151-154 (July 21) 1934.

2. Lewis, Thomas: Diseases of the Heart, New York City: The Macmillan Company, 1933.

tion, the metabolic rate is increased, and the tissues give out more energy and therefore more oxygen is required by them. If the heart reserve is lessened, it will not be able to send the extra supply of oxygenated blood out through the arteries to these tissues. The individual, in an effort to get the needed supply of oxygen, will breathe faster. As the heart gradually loses its reserve, it will not be able to force the blood onward when the body is at rest, and the individual may become breathless while resting in bed.

Fig. 1.—Roentgenogram showing blood supply of average heart with arteriosclerotic changes in vessels.

This condition indicates that the heart is using its last reserve.

While talking to the patient, ask whether he frequently has sharp pains in his chest which are referred down his left arm, or at times has a feeling of weight over the heart. During the conversation, other symptoms may be mentioned that should not be disregarded. Patients having cardiac failure are often troubled with insomnia and are often restless, and they may give a history of having attacks of extreme nervousness. Attacks of dizziness, vertigo and nose bleed are often associated with high blood pressure. Cardiac failure should always be suspected when there is a history of acute rheumatic fever, syphilis, scarlet fever, acute streptococcic infection or any other severe infection, because these conditions tend to weaken the heart muscle.

The blood pressure is a reliable guide to the condition of the circulation. It is well to ask all adult patients when their blood pressure was last taken and whether it was high at that time. If the

Fig. 2.—Clubbing of fingers due to long-standing cardiac failure.

dentist uses any type of general anesthesia in his office, he should thoroughly study the use of the sphygmomanometer and the significance of its reading. There are two blood pressures to be read, the systolic and the diastolic.[3] The average adult has a blood pressure of 120-130 mm., systolic, and 80-90 mm., diastolic. As age increases, the blood pressure has a tendency to rise. The youth of 20 probably

3. White, P. D.: Heart Disease, New York City: The Macmillan Company, 1931.

has a blood pressure of 120 mm., systolic, and we may expect the pressure to rise as he grows older at the rate of about 1 mm. every two years. Pressure readings of 135 mm., systolic, and 95 mm., diastolic, or over should be considered pathologic at any age. The extremely low blood pressure of 90 mm., systolic, and 50 mm., diastolic, or lower are also pathologic. An abnormally low diastolic pressure is always serious because it indicates that the heart muscle is poorly nourished. The systolic pressure is affected by such emotions as fear, worry and apprehension. The diastolic pressure is not so variable and is therefore the more reliable reading.

The difference in millimeters between the systolic and the diastolic pressure, called the pulse pressure, represents the amount of force the heart must exert in order to move the blood onward through the arteries, after it has overcome the diastolic pressure, or the pressure that is in them during the rest period of the heart. The ratio between this pressure and the diastolic reading is important as it offers the earliest danger signal. It may be found by dividing the pulse pressure by the diastolic pressure. Normally, this ratio should be about 1:2. We may say that if the ratio between the pulse pressure and the diastolic pressure is between 2:5 and 3:5, the heart is in fairly good condition.

The dentist may get a fair idea of the condition of the patient's heart by the length of time he can hold his breath. If he cannot hold it longer than thirty seconds, the heart muscle may be weakened. A fairly accurate means of determining the condition of a heart is an exercise test. First, the pulse rate is taken, then the patient is asked to hop on one foot several times. After a rest of one minute, the pulse rate should return to normal if the heart is in good condition. Another index to the heart is the hemoglobin, the solid part of the blood that carries the oxygen. Normally, about 90 per cent of the solids

Fig. 3.—Appearance of patient with exophthalmic goiter; showing protrusion of eyeballs and enlargement of neck. This is an advanced case of goitrous heart.

Fig. 4.—Engorgement of jugular vein in congestive heart failure.

within the blood is hemoglobin. If it is considerably below normal, say 60 per cent, the heart is forced to work harder to get the required amount of oxygen to the tissues. This overwork soon impairs the heart. When the hemoglobin is below 70 per cent, the case should be treated as a heart disease. The dentist who practices surgery will profit by purchasing a hemoglobinometer. With this instrument, he can accurately take the hemoglobin for any patient who is about to have an extensive oral operation. Patients with a low hemoglobin index have a much greater tendency to hemorrhage.

There are also many physical signs of cardiac failure that the dentist may note. In cases of extremely low blood pressure or peripheral anemia, the patient may be pale. Flushing of the face may be seen in fever, excitement and aortic insufficiency and arterial hypertension. Any degree of cyanosis should be noted, being indicated by a bluish tinge usually about the lips, ears and finger nails, indicating that the blood is not being properly aerated owing to poor circulation.

The superficial veins of the body may be distended. The weakened heart is unable to transfer the normal amount of blood to the arterial side, and the increased amount of blood left on the venous side causes a distention of the veins. When the venous pressure becomes very marked, the excess fluid of the blood passes through the vessel walls into the tissue of the body causing edema, or dropsy. As this usually occurs at the end of the day, the patient should be asked whether he has noticed that his ankles become swollen at the end of the day. As cardiac failure advances, the fluid often collects in the abdomen, a distention, known as ascites, resulting. Renal edema or edema caused by dysfunctioning of the kidneys, which are unable to carry off the proper amount of fluids, usually appears in the morning and is noticeable in the face and the soft tissues about the eyes, and on the dorsum of the hands. This

Fig. 5.—Enlarged tortuous vessels in arm, in case of arteriosclerosis.

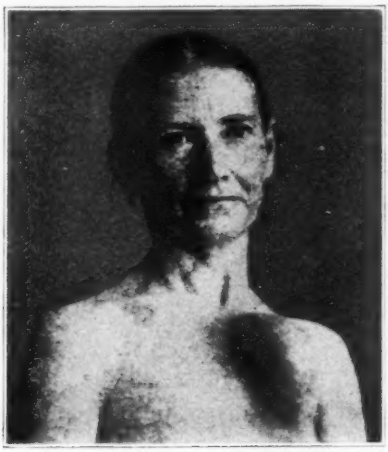


Fig. 6.—Bulging of chest wall due to aneurism in severe case of cardiac syphilis.

condition is usually associated with a poor circulation.

When there is a long-standing stasis of the pulmonary circulation or long-standing cardiac disease, the ends of the fingers become clubbed. The pupils of the eyes should be noted.[4] An inequality of the pupils may be due to a thoracic aneurysm pressing on a sympathetic nerve. A bulging of the chest wall may be caused by an aneurysm or inflammation of the pericardium with effusion. In cases of high blood pressure, the arteries of the neck may be seen to pulsate. This is also seen in patients having exophthalmic goiter. There is always a cardiac involvment in these cases, the heart being either hypertrophied or dilated from the excessive work that is thrown on it.

The additional work may be due to one of two conditions: The pressure of the enlarged thyroid may cause some mechanical interference with the circulation or respiration, thus placing additional work on the heart; or, more often, an increase in the amount of thyroid secretion that has been thrown into the circulation by the enlarged thyroid, may cause the metabolic rate to be greatly increased. It is usually not difficult to recognize these cases. The patient is very nervous, restless and hypersensitive, and may have attacks of rage or crying, brought on by some insignificant matter. The eyeballs protrude and there is usually a staring expression. The pulse is rapid, varying from 120 to 160 beats per minute. Likewise, rapid pulsation of the arteries of the neck may be seen.[5] These symptoms may not always be so pronounced, and at times the only symptom present may be an increased pulse rate associated with a

Fig. 7.—Necropsy specimen from case of coronary thrombosis. The ventricular wall is thin and there is scar tissue present in this serious form of heart disease.

Fig. 8.—Appearance of patient in case of mitral insufficiency complicated with pericardial effusion. The facies is of the mitral type and there is bulging of the chest wall.

4. Morris, L. M.: Cardiac Aneurysm, Am. Heart J., 2:548-559 (June) 1927.

5. Bram, Israel: Rôle of Dentist in Goiter Cases, J.A.D.A., 18:1544 (Aug.) 1931.

tremor of the fingers when the arm is extended.

The pulse should also be noted, as it is a good index to the condition of the heart. The dentist should be able to detect readily the most common pulse irregularities. The pulse should not be palpated with the thumb as there is normally a pulsation in the thumb which may be felt, an error in the interpretation resulting. The normal rate is between 70 and 80 beats a minute. Excitement or emotional strain will cause a rise in this rate. Any great variation from normal, the rate being either too fast or too slow, indicates cardiac impairment. An intermittent or irregular pulse, when there is an omission of one or more beats, should lead the dentist to treat the case as cardiac; although this condition is often found to be independent of any detectable heart disease.

The volume of the pulse should be noted. A full, bounding pulse may indicate hypertension. A feeble beat may be noted in weak debilitated patients with a poor circulation and in anemic patients. Since the quality of the heart beat can be fairly well judged by taking the pulse, I do not think it necessary for the dentist to use the stethoscope. Continual practice with this instrument is required to interpret the heart sounds with any degree of accuracy, and therefore the average dentist will not, I believe, derive much benefit from its use.

Cardiac failure is often associated with tuberculosis, nephritis, diabetes and pernicious anemia, and other infections and disorders of long standing. The same precautions should be taken in these cases as in any other cardiac disturbance.

What are the precautions that a dentist should take when caring for a patient with cardiac failure? First of all, he should get in touch with the patient's physician, and report the work he expects to do for the patient. After the physician has given permission to proceed with the work, the responsibility is shared by him.

The dentist should also remember that persons suffering from any degree of cardiac failure should lead a quiet life free from undue fear, excitement, worry or great physical activity. These patients are very often nervous, hypersensitive and irritable, and the visit to the dental office may cause them to become quite excited.

They usually react quickly to the atmosphere surrounding them; and the calm, cheerful dentist, by using a little tact and patience, will gain their confidence. They then are usually cooperative while the dental work is being done.

Premedication before operations is for these patients very desirable. Some derivative of barbituric acid has proved most beneficial. We usually give sodium amytal, 3 grains, or nembutal, 1½ grains, from thirty to forty minutes before the operation. With premedication, the patient will be in a calmer and more receptive mood, and the possibility of any psychic shock is lessened. The injections should be made as painless as possible by the use of a weak solution of cocaine or a 2 per cent pantocaine on the mucous membrane. We prefer pantocaine as it is not so toxic as cocaine. It must be remembered that these patients do not tolerate epinephrine well as it raises the blood pressure and places an extra amount of work on the heart. The solution for local anesthesia should contain the least amount of epinephrine possible. Premedication with one of the barbiturates tends to combat this rise in blood pressure and thereby increases the tolerance for local anesthesia. It should be given as a prophylactic, if there is any uncertainty in regard to the patient's heart.

When doing work for persons having a cardiac disturbance, it must be remem-

bered that they do not tolerate a large amount of work at one time. This is to be especially remembered when surgical procedures are indicated. The judgment of both physician and dentist is necessary in deciding such matters as the amount of work that may be done at one time, the type of anesthesia that should be used and whether hospitalization is necessary. Removing too many infected teeth at one time may precipitate heart failure and even cause death. It is not advisable to keep these patients in the dental chair for more than thirty to forty-five minutes at one time. In most extractions, the patient is of middle age or older. As it is during this age that most of the cardiac complaints occur, it is necessary that we be sure of the condition of the heart before we attempt extensive operations for these patients.

Local anesthesia[6] is preferred to general anesthesia for extractions in cases of cardiac failure. When these patients receive proper premedication and are tactfully handled, they experience little or no shock if only a few teeth are removed at a time. Most of them will stand a general anesthetic well if it is given correctly. It is absolutely necessary that these patients do not struggle while under anesthesia, as this throws extra work on the heart. It is also necessary that no asphyxial strain be thrown on the heart. The respiration should be kept free from embarrassment, and as wide a margin of oxygen as possible should be given with the anesthetic gas. If the circulation is already impaired, any degree of asphyxia places a greater strain on the heart. Anesthetic tension should not be established in these patients by cutting off the oxygen. Death may take place after the briefest period of cyanosis.

Nitrous oxide-oxygen, the least toxic anesthetic that we have at present, is the one most generally used by dentists. It must be remembered that this is not so powerful as some of the other anesthetics, and it may be difficult to maintain the proper degree of anesthesia, unless the patient is somewhat cyanotic.[7] Many of our better known anesthetists tell us that it is more desirable to add a small amount of ether to the gas-oxygen mixture than to limit the oxygen to this extent. Administration of ether tends to have a toxic effect on the kidneys, and we do not like to employ it in heart cases, yet a very small amount of it will do less harm than a period of cyanosis. Ethylene is the preferred anesthetic in these cases. It is more powerful than nitrous oxide and more oxygen may be given with it and the proper degree of anesthesia still be maintained. Owing to its explosive properties, it has not been used widely in the dental office. We may say that a more important consideration than the type of anesthesia used is probably the competence of the anesthetist.

Since it is imperative that the anesthetic be given properly, it is always advisable to insist that these patients enter the hospital to have any oral surgical operation when a general anesthetic is indicated. Here, a trained anesthetist will administer the anesthetic and resuscitative measures can be immediately employed in cases of syncope, respiratory failure and shock. Saline and glucose solutions have been prepared and may be given immediately when needed. These solutions, when placed in the blood stream, raise the blood pressure and help combat shock. Whenever a dentist is obliged to do extensive work for a pa-

6. Lundy, J. S.: Anesthesia in Presence of Grave Surgical Risk, Report at Staff Meeting, The Mayo Clinic, 1935.

7. Hewitt, F. D.: Anesthetics and Their Administration, a Textbook for Medical and Dental Practitioners and Students, Ed. 4, New York City: The Macmillan Company.

tient with advanced cardiac disease, it should always be done in the hospital.

If any difficulties arise in the office, the dentist should be able to render first aid. Fear, when about to have an extraction, may cause certain patients to faint. This is the most common difficulty that the dentist encounters. In this condition, the blood has left the brain and the patient is in a mild degree of shock. The patient's head is lowered so that the blood will flow back to the brain. A few breaths of spirits of ammonia will increase the respiration rate and facilitate oxygenation of the blood. Alpha lobelin is a good respiratory stimulant. It comes in ampules and is given intramuscularly. If the pulse is weak and the patient does not respond readily, a heart stimulant should be given. Caffeine solution benzoate 7½ grains, epinephrine, 0.5 to 1 c.c. or coramine 1 ampule may be given intramuscularly. The dentist should keep a sterile hypodermic syringe ready at all times. Coramine may be obtained in a preparation to be given orally. We find that 20 drops of this solution in a little water will aid greatly in reviving a patient. All dentists should be able to administer artificial respiration correctly. If they have a gas machine, it is well to have it equipped for carbon dioxide administration, as this is a very effective respiratory stimulant.

Certain types of cardiac failure demand the most careful attention and consideration. Patients suffering with angina pectoris, syphilitic aoritis, coronary thrombosis, aneurysm, advanced goiter affecting the heart and severe hypertension are in this class. These patients often die suddenly. It is always important that they be examined by their physician and his aid be obtained in deciding such matters as premedication, and the time and place to operate.

Pearls of amytal nitrate or nitroglycerine tablets should be kept at hand for patients suffering with angina pectoris. These drugs dilate the coronary arteries, which supply the heart muscle with blood, and the patient obtains relief from the pain that is characteristic of this type of heart disease.

The necessity for the proper management of patients with cardiac disturbances, as well as patients suffering with other systemic disorders, is so important that I would suggest that our study clubs take up these subjects. A review of these disorders the manifestations of which may be present in the oral cavity and the complications that may arise from surgical interference are subjects study of which would greatly benefit the dentist. These are points that our dental education too often neglects. A study of these subjects will give the dentist a broader insight into the field of medicine, and enable him to cooperate more closely with the physician. The progressive dentist of today appreciates the bond that now exists between the medical and the dental profession. This bond of interdependence seems to me to be a necessity if we are to keep the patient's interest at heart.

1002 National Bank Building.

CIVILIZATION—A DISEASE*

By P. J. BREKHUS, B.A., D.D.S., F.A.C.D., and W. D. ARMSTRONG, Ph.D.,
Minneapolis, Minn.

THE prevention of disease and the extension of human life has been the utopian aim of the healing profession, and these efforts have not been without reward. The story of the control and elimination of such diseases as smallpox, typhoid, yellow fever, malaria, diphtheria, rickets, scurvy and pellagra is well known and need not be repeated. In the medical curriculum, the course in preventive medicine holds a most important position. We know the saying about the ounce of prevention and the pound of cure.

The dental profession as a branch of the healing art deserves full credit for its heroic efforts to control and prevent that most prevalent of all human ills, dental caries, and its consequences.

In the records of the remote past, we find abundant proof that diseases of the teeth and their investing tissues came into evidence with the earliest signs of civilization. We learn from Herodotus[1] that among the Egyptians, in a very remote period, the care of teeth was assigned to dental specialists; and from the Eber Papyrus,[2] we find that prophylaxis was practiced. The famous dentifrice composed of powdered flint, green lead and honey in equal parts gives testimony to this fact. According to the best authorities, there is no evidence of restorative dentistry among the early Egyptians and Hebrews. On the other hand, among the Greeks and Romans, Phoenicians and Chinese, we find abundant evidence of restorative and replacement dentistry.

In Rome, during the first century A.D., the height of Roman civilization, we find, according to Marcus Valerius Martial,[3] that restorative dentistry was well developed and greatly in demand. We also learn from a statement in his book of epigrams that oral hygiene was practiced as a specialty at that time.[4] "A dentifrice says to an old woman with an artificial denture, 'What have I to do with you? Let the young women use me. I am not wont to polish purchased teeth.' " How do these Roman dentifrices differ from our American dental creams and powders? Martial seems to find much amusement in watching the ladies of his day struggling with their artificial teeth. Speaking of two of his acquaintances, he says[5]: "Thais has black teeth; Laecenia has white teeth. What is the reason? Thais has her own; Laecenia has purchased teeth." At times, he seems to scold them.[6] "You use," he says to one, "and are not ashamed, teeth and hair that you have bought. What would you do for an eye? That cannot be

*A Report on a Statistical Study of Age Incidence in Dental Caries and Types of Treatment in 14,934 Clinic Patients in the School of Dentistry, University of Minnesota.

1. Guerini, Vincenzo: History of Dentistry, Philadelphia: Lea & Febiger, 1909, p. 25.

2. Footnote 1, p. 20.

3. Loeb Classical Library, Martial Epigrams, Vols. I and II.

4. Footnote 3, Vols. XIV and LVI.

5. Footnote 3, Vols. V and XLIII.

6. Footnote 3, Vols. XII and XXIII.

bought." And again,[7] "And you (Galla) lay aside your teeth at night just as you do your silk dresses." Much more can be quoted, but this gives sufficient evidence that dental diseases were prevalent and restorative dentistry was well developed at the height of Roman civilization.

Hippocrates[8] made the significant statement that disease must be combated at its source. Knowingly or not, the father of medicine here sounded the keynote of the search after the cause of disease. This search has been carried on by the scientifically minded members of the profession throughout the centuries; and it is quite evident that the diseases of the oral cavity have received their share of attention.

It has often been stated in a derogatory spirit that dentistry is nothing but mechanics and no one but mechanics are interested in dentistry. This is by no means the whole truth. The biologist is interested in teeth because, in the evolutionary changes, he can trace the progress of living species. The anthropologist is interested in teeth because, in the study of their shape and structure, he discovers the path of man. The pathologist is interested in teeth because, in their diseases, he discovers physical unbalance. Sir Arthur Keith[9] declares, "The teeth are the key structure providing clues to bad health, and teeth are more susceptible than any other structure of the body to changes which are produced by civilization." The sociologist and economist are interested in teeth because their diseases become a health problem affecting the economics of society. The dentist is interested in teeth because his problem is to alleviate human suffering by correcting anatomic disharmony and by the repair and replacement of diseased structures.

It would be of interest and profit to spend some time with the philosophers and scientists, such as Aristotle, Hippocrates, Galen, Ambrose Paré, Leeuwenhoek, John Hunter, Fox, Ritzius and Nasmyth. They all left contributions to dental science.

We are so apt to forget that the present is but a child of the past and that the achievement of science today would have been impossible if it had not been for the pioneer work of the masters who brought us out of the jungle of superstition into the highway of deductive and inductive thinking. Realizing that it is not within the scope of this report to bring out the

Table 1.—Age Distribution, with Percentage of Defective and Sound Teeth in Females

Age Years	No. of Cases	No. of Teeth	Defective Teeth		Sound Teeth	
			No.	Per Cent	No.	Per Cent
10-20	1,860	52,080	21,411	41.11	30,669	58.89
21-30	2,100	58,800	28,696	48.80	30,104	51.20
31-40	1,620	45,360	24,968	55.04	20,392	44.96
41-50	960	26,880	16,106	59.92	10,774	40.08
51-60	621	17,388	11,457	65.89	5,931	34.11
Over 60	320	8,960	6,329	70.64	2,631	29.36
Total	7,481	209,468	108,967	52.02	100,501	47.98

7. Footnote 3, Vols. IX and XXXVII.

8. Footnote 1, p. 61.

9. Shaw, J. C. M.: Teeth, Bony Plate and Mandible in Bantu Races of South Africa; foreword by Sir Arthur Keith, p. xiv, London: John Bates and Son.

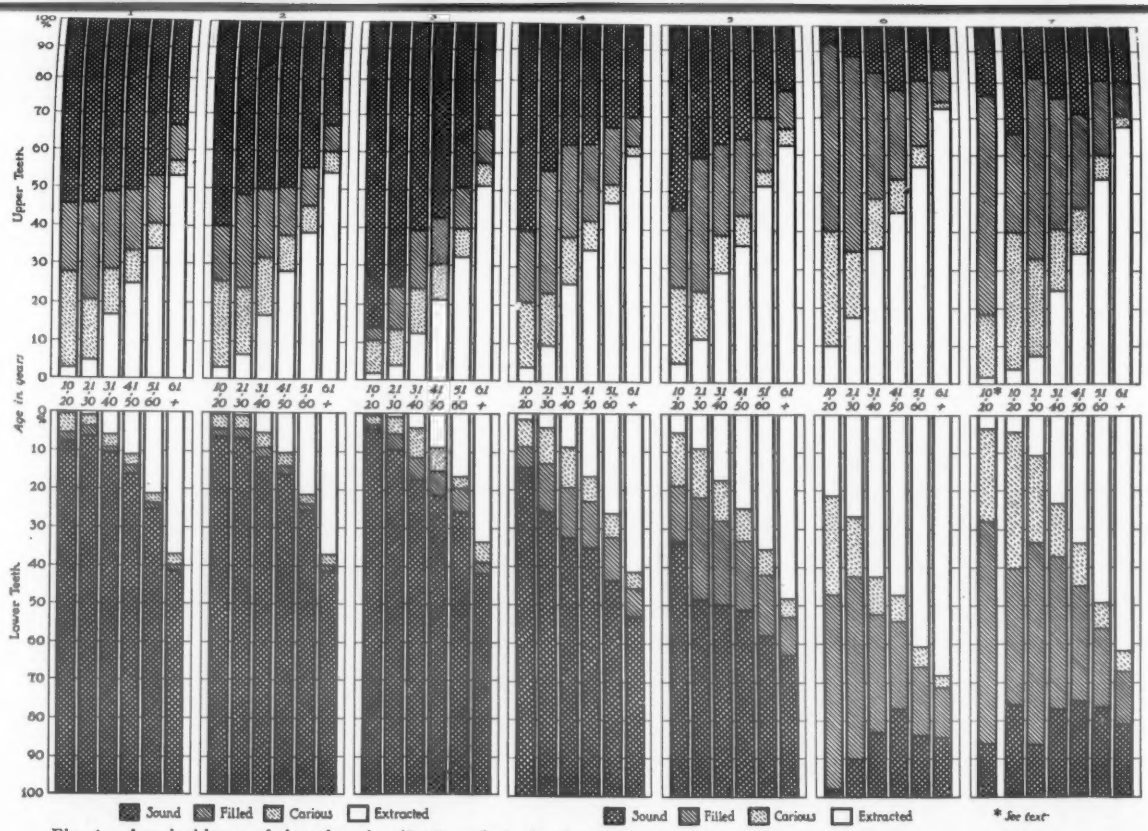
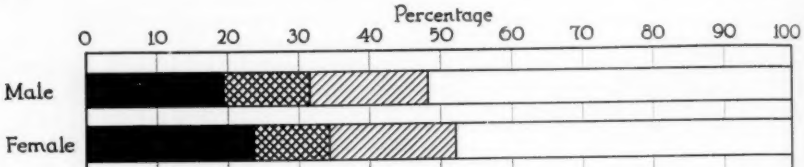


Fig. 1.—Age incidence of dental caries (7,453 males). In the 10-20 year age group, a number of the patients examined are below 12 years of age (before the second molar is erupted). Unerupted teeth were marked "Sound." This distorts the true average percentage of sound second molars in this group. As an indication of the true average percentage of decayed second molars, the column to the left in bracket 7, taken from a study of the University of Minnesota students, average age 18, is inserted.

achievements of the remote past, we will confine ourselves to a brief review of what has been accomplished during the past four or five decades, keeping in mind that it is but a continuation of studies that have been in progress for centuries. The scene is rather too close to give the best perspective, but the period is long enough to have had its effect on society.



Total number of teeth examined: male, 208,684; female, 209,468

Fig. 2.—Dental condition of clinic patients, School of Dentistry, University of Minnesota.

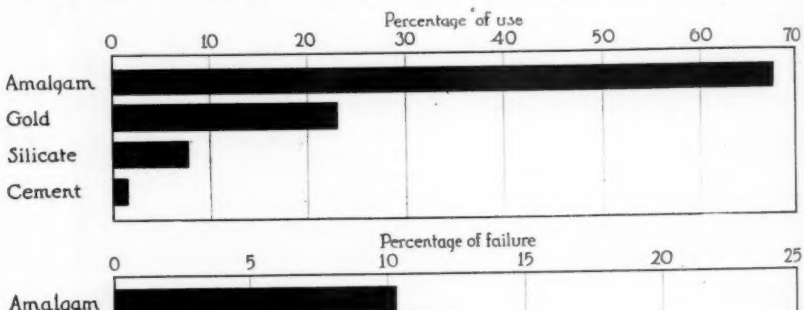


Fig. 3.—Data on filling materials.

In prevention of disease, the cause (or source, as Hippocrates termed it) must be discovered. The first announcement of the discovery of the cause of dental caries (based on modern scientific investigation) was made by W. D. Miller, in 1890.[10] And we all know what effect it had on the dental profession. If dental caries were caused by acid-producing bacteria operating under gelatinous plaques on sheltered surfaces of the teeth, the treatment would be to remove the gelatinous plaques and keep them from forming. This set J. Leon Williams thinking; and we have his famous dictum: "A clean tooth does not decay."

10. Miller, W. D.: Brit. J. D. Sc., 31, 1888; 33, 1890.

You all know what happened. Dr. Williams' statement became a slogan; and under the banner on which it was inscribed, the dental profession marched for many years.

According to this theory, prevention of dental caries became mainly a matter of self-administered treatment, and unselfishly the dental profession set about to educate the public as to how to avoid the need for expensive dental care. Through committees appointed and approved by organized dentistry, educational bulletins[11] were prepared and circulated to parent and teachers' associations and to service clubs such as Rotary, Lions and Kiwanis; to church audiences, radio audiences; to factory workers, mothers, expectant mothers, etc.

As you know, Alfred G. Fones, [12] of Bridgeport, Conn., established the first school for dental hygienists in the United States. This was in 1913—twenty-two years ago. The idea percolated with little resistance through the dental profession; and we have, at present, eleven dental schools giving one-year courses and five giving two-year courses for dental hygienists. The total number of graduates up to 1934 was 4,200.

THE AGE OF VITAMINS

From clinical experience and close observation, it became evident to the practicing dentist that the "clean tooth" theory did not fulfil all its promises; and it was not long before doubts were expressed that this theory embodied the whole truth and nothing but the truth; and the researchers marched on.

During this time, a group of scientists had been engaged in the study of nutrition-deficiency diseases such as scurvy,

11. Educational bulletins: (a) Preventive Dentistry (for parent-teacher associations), American Dental Association. (b) A Clean Mouth Is Essential to Good Health (for parent-teacher associations), American Dental Association. (c) Care of Children's Teeth (for parent-teacher associations), American Dental Association. (d) Taking Care of the Teeth (for parent-teacher associations), American Dental Association. (e) Health Education (for service clubs, such as Rotary, Kiwanis, Lions and Exchange), American Dental Association. (f) A Constructive Program for Dental Health (for service clubs, such as Rotary, Kiwanis and Lions), American Dental Association. (g) Teeth and Health (for a church audience), American Dental Association. (h) How Many Teeth Will You Have Left When You Are 80? (for a radio audience), American Dental Association. (i) Dental Health (for high school students), American Dental Association. (j) Clean Teeth as an Asset (for high school students), American Dental Association. (k) The King's Soldiers (for the primary grades), American Dental Association. (l) The Story of the Food Chopper (for the primary grades), American Dental Association. (m) Scrubbing the Door Steps (for grammar school pupils), American Dental Association. (n) Better Teeth for Factory Employes (for factory workers), American Dental Association. (o) Value of Oral Hygiene in Prevention of Dental Caries, by Charles F. Bödecker, D. Survey, 9:18 (Oct.) 1931. (p) Dietetics Applied to Oral Health. Compiled by the American Academy of Periodontology, 1927; distributed by the American Dental Association. (q) Children's Teeth—How to Use and Keep Them—Part I. Compiled by the American Academy of Periodontology, 1923; distributed by the American Dental Association. (r) Children's Teeth—How to Use and Keep Them—Part II. Compiled by the American Academy of Periodontology, 1924; distributed by the American Dental Association. (s) Spare the Sweets and Save the Teeth, by Lou Lombard, J.A.D.A., 11:1246 (Dec.) 1924. (t) How to Build Sound Teeth. Compiled by the American Academy of Periodontology, 1923; distributed by the American Dental Association. (u) Miscellaneous: (1) Foods and Teeth. (2) To Mothers. (3) First Permanent Molars. (4) To Girls. Distributed by Bureau of Public Relations, American Dental Association.

12. Fones, A. G.: Training School for Dental Nurses, Oral Health, 4:66-69, 1914.

rickets and pellagra.[13] This study led to the discovery of the vitamins, a most valuable contribution to medical science, which led to the control and cure of these diseases. Here was a suggestion for dentistry: Could dental caries and other oral diseases be charged to faulty diet? If so, here was a real problem for research, and the problem was accepted with enthusiasm by the best men available in science.

The story of vitamins in dentistry is romantic, but the scene is too near at hand to permit a full interpretation. If vitamins were the decisive factor in diseases of the teeth, the problem would be to find the right ones, and add them in sufficient quantities to the diet; and the problem of dental caries would be solved.

Experimental laboratories are numerous both in the United States and on the continent, where mice and rats, guinea-pigs, cats and dogs, monkeys and men are experimented on. Vitamins are carefully separated, added and subtracted in order to discover what rôle each plays in the body-building process. Occasionally, new vitamins are discovered and added to the list. The game is most fascinating. The trick is to produce dental disease in animals by removing the tooth-building vitamins from the diet. It is a most difficult task. The experimental animals by nature have good teeth—all animals have—and when, occasionally, it is possible to produce dental decay and pyorrhea, the guinea-pig and the rat are ruined for life; while civilized human beings can live a full and apparently healthy life with decayed teeth and pyorrhea. A good many get along without any teeth, and it seems not to reduce their life expectancy. The search has been carried on for more than two decades; and if I am not misinformed, the specific tooth-building vitamin is still at large.

13. (a) Diagnosis and Treatment of Scurvy, M. & S. Rep.; abstr. D. Cosmos, 21:528 (Sept.) 1879. (b) Skull Changes in Rickets, Am. J. D. Sc., 10, third series, 1876-1877. (c) Malnutrition, A Dental Disease, Brit. J. D. Sc., 28:215, 1885. (d) Pathology of Scurvy, Lancet; abstr. D. Cosmos, 19:555 (Oct.) 1887. (e) A Form of Land Scurvy, M. & S. Rep.; abstr. D. Cosmos, 22:218 (April) 1880. (f) Scurvy, Lancet; abstr. D. Cosmos, 24:546 (Nov.) 1882. (g) Treatment of Scurvy, M. & S. Rep.; abstr. 25:49 (Jan.) 1883. (h) Syphilis and Rachitis, Am. J. D. Sc., 18:239-240, third series, 1883-1884. (i) Pathogenesis and Etiology of Rachitis, Berl. klin. Wchnschr.; abstr. D. Cosmos, 22:219 (April) 1880. (j) Rachitic Diathesis, M. & S. Rep.; abstr. D. Cosmos, 25:267 (May) 1883.

ORAL HYGIENE VERSUS VITAMINS

The theories of oral hygiene and of vitamins are both legitimate children of modern science—almost twins. They both have their enthusiastic supporters among the best men in the dental profession, and many lively debates have been carried on between the two sides. One of the most recent of these debates took place at the Pennsylvania Hotel, New York City, Thursday evening, March 27, 1934.[14] The subject: "Resolved, that a clean tooth does not decay and that mouth cleanliness affords the best known protection against dental caries," was debated by six of the most prominent men in dental science, Hyatt, Walker and Williams for the affirmative and McCollum, Price and Merritt for the negative. The debate lasted far into the night, but no vote was taken. I shall not burden you with any quotations or opinions of my own. A full report of the debate has been published.[14]

REACTION OF THE PUBLIC

The public, or the 100,000,000 guinea-pigs, as Arthur Kellet[15] calls them, seems to have been eager to be experimented on

14. D. Cosmos, 76:860 (Aug.) 1934.

15. Kellet, Arthur: 100,000,000 Guinea Pigs.

with whatever remedy science had to offer. During the depression year of 1933[16] (according to figures released Dec. 31, 1934), more than $70,000,000 was paid by the American public for one item alone—tooth paste—a fair offering to the clean tooth theory. From the records, we find that the vitamin theory has had an equally favorable reception. You all recall what an impetus the dairy industry received some years ago. The milling industry came up for investigation, and may have profited by it; then the Fruit Growers Association. Some clever fellow—I forget his name—discovered that sunshine was a great life-giving medium; and more than that. In a certain part of the spectrum were found millions of tooth-building vitamins floating about. The California Fruit Growers Association became interested and financed laboratories to study tooth vitamins stored in the California orange. They found them. Look at their ads.

Then came the drug manufacturers and patent medicine makers with tooth-building vitamins in concentrated form. You can get them by the millions in tiny capsules. You all know the story of the cod and the halibut—how they have laid down their lives in order to preserve the teeth of civilized man. Cod liver oil and haliver oil in the pure state and with the addition of viosterol, ultraviolet rays and flavorings of all tastes have been consumed by the carloads—millions and millions of dollars worth—in the name of the vitamin and in the hope of saving decayed molars.

16. Palmer, B. B.: Paying Through the Teeth, New York: The Vanguard Press, p. 51, 1935.

EFFECT ON HUMAN TEETH

The dental profession is naturally interested in the result of this gigantic experiment and enough time has elapsed to tell the tale. In order to gain this information, numerous surveys on dental caries have been undertaken by national, state and local dental organizations, mostly among children of school age. The findings are most interesting.

I wish here to present a study of this kind just completed at the School of Dentistry of the University of Minnesota. The material was collected over a period of two years. It covers complete case records of patients from 10 to over 70 years of age, 7,453 male and 7,481 female, a total of 14,934. The number of teeth recorded, not including the third molars, is 418,152. Including the third molars, there are 477,888. The third molars have been recorded, but because of the difficulty of getting accurate information about them, they have been left out of these tabulations.

TABLE 2.—AGE DISTRIBUTION, WITH PERCENTAGE OF DEFECTIVE AND SOUND TEETH IN MALES

Age	No. of Cases	No. of Teeth	Defective Teeth		Sound Teeth	
			No.	Per Cent	No.	Per Cent
10–20	2,100	58,800	24,136	41.05	34,664	58.95
21–30	2,040	57,120	27,300	47.79	29,820	52.21
31–40	1,170	32,760	16,242	49.58	16,518	50.42
41–50	1,050	29,400	14,703	50.00	14,697	49.99
51–60	572	16,016	8,985	56.10	7,031	43.90
Over 60	521	14,588	9,456	64.82	5,132	35.18
Total	7,453	208,684	100,822	48.31	107,862	51.69

In this study was recorded the condition of every tooth as to extractions, untreated caries and fillings, including the different types of fillings, such as gold, amalgam silicate and cement. The percentage of failures of each type of filling was also recorded. The replacements, such as bridges and partial and full dentures, are also tabulated, but not included in this report.

In classifying the material, we divided the patients into six age groups, each covering ten years. The sexes were studied separately. Starting with ten years, which is the age of the youngest patients coming to this department, we have in the first age group those from 10 to 20; in the second, those from 20 to 30; and so on to 60 and past. The number of patients in each group of the males is as follows: 10 to 20, 2,100; 20 to 30, 2,040; 30 to 40, 1,170; 40 to 50, 1,050; 50 to 60, 572; 60 plus, 521. The distribution of ages among females was very similar.

In order to understand Figure 1, a little explanation may be secessary: it looks complicated at first glance, but with a little orientation you will find it extremely simple. The chart is divided into two halves: the upper and the lower. These represent the upper teeth on the left side of the jaw, and the corresponding lower figures represent the lower teeth on the same side. The six columns within each bracket represent the condition of the individual teeth in each age group.

This chart contains information about dentistry too voluminous to be discussed in detail at this brief session. It tells the story of extracted teeth in the different age groups and which teeth suffer most. It shows us the thousands of unfilled cavities in teeth which will fall victims to the dental forceps if they are not cared for at an early date. It shows us the repair work that has been done, the percentages of each kind of filling material used and the percentage of failure of each kind. But what is most interesting, to me, is the story it tells about the prevalence of dental caries in each age group.

By a glance at the area in each column representing the percentage of sound teeth, we find that this varies not only in the different age groups, but also in the different teeth in the same age group. This indicated the difference in susceptibility to caries in the different teeth. The differences are so marked that teeth may be classified in three groups: the comparatively immune, the susceptible and the very susceptible. The lower six anterior teeth, the lower first bicuspid and the upper cuspid belong in the first group. The upper central and lateral incisors, upper first and second bicuspids and lower second bicuspids fall in the second group. The upper and lower molars come in the third group. We may mention that this marked difference in caries susceptibility suggested a study of the composition and structure of the different teeth. This research has been carried on for two years at the University of Minnesota under the direction of one of us (W. D. A.), and reports of work in progress have been given on two occasions before the International Association of Dental Research. The final report is yet to come.

In comparing the relationship of age to dental caries, we find that the greatest damage is done in the early age groups. This is specially noticeable in the caries-susceptible teeth. In the upper incisors, for example, we find from 40 to 50 per cent caries in the 10 to 20 year group. We have evidence that this damage was done in the early teens. In the older groups, we find little increase in caries, but the percentage of extractions

increases very rapidly as age advances. In the molars, the teeth most susceptible, the picture reverses. In the 10 to 20 year group, we find 3 per cent sound teeth; in the 20 to 30 year group, we find 10 per cent sound teeth; in the 30 to 40 year group, we have 15 per cent sound teeth; in the 40 to 50 year group, we have 23 per cent sound teeth; and in the two older age groups, we have 16 and 15 per cent, respectively. In the upper molars, we find the same relationship, and on both sides of the jaws and in both sexes. This is rather an unexpected situation; at least, I was much surprised. In order to insure the validity of the figures, the material has been checked and rechecked by expert statisticians and biometricians at the University of Minnesota.

Here, we have the children who have been victims of vitamins and prophylaxis and scientific dentistry checked against their parents and grandparents; and we find 3 per cent against 23 per cent of sound molars. Rather interesting, is it not? I don't think that we should hasten to blame the toothbrush and the cod liver oil. I don't believe that they have much to do with it one way or the other. I believe that a lot of money has been wasted, especially on vitamins. For an explanation of this phenomenon, it becomes necessary to take a close look at the material under investigation.

In this group of almost 15,000 patients—children, parents and grandparents—are included many who had survived the hardships of pioneer life. Many are the children of pioneers, born in the open on the prairies or under the shelter of the covered wagon without the aid of nurses and doctors. Beside them are others who had both prenatal and postnatal care, with all sorts of dietetic and hygienic precautions for mother and child. The pioneers knew nothing of toothbrushes and tooth pastes and mouth washes, while their children's children went to school with the toothbrush in their pockets in order to gain the coveted gold star.

The years covered by the lifetime of the patients included in this study have been years of the most revolutionary changes that the world has ever gone through. It takes but a Rip Van Winkle's nap to transfer you from the sod hut to the most modern dwelling; to take you off the ox cart and the lumber wagon for a ride in a luxurious automoblie or air conditioned train or a bridge party over the Twin Cities in a trimotor plane. Compare the rapid transmission of human knowledge over the telephone and radio with the old stage coach mail service. What has all this to do with decayed molars?

Dr. Pickerill[17] made the following statement in 1914: "Dental caries is, to a great extent, a disease accompanying civilization, its numerical incidence being largely conditioned by the state of civilization to which a particular race has attained."

In a recent survey on 2,400 school children,[18] Joseph T. Cohen reports that poor children have the best teeth. Statistics gathered in the state schools in England show that the poorest children have the best teeth.[19] In a study of dental caries in school children by the St. Louis Dental Society,[20] it is reported that colored children have 50 per cent less caries than white children.

17. Pickerill, H. P.: Prevention of Dental Caries and Oral Sepsis, Chap. II, p. 9, 1934.

18. Cohen, Joseph T.: Statistical Study of Caries in Deciduous and Permanent Teeth of Children, J.A.D.A., 23:312 (Feb.) 1936.

19. Day, C. D. M., et al.: High Sugar Diets and Dental Caries in White Rat, J.A.D.A., 22:915 (June) 1935.

20. Report of Committee on Public Dental Education, St. Louis Dental Society, 1934, p. 66.

The studies of Drs. Magitot,[21] Mummery[22] and Patrick[23] have often been referred to and all agree with Dr. Pickerill's statement. A great many more investigators may be quoted, but this seems sufficient evidence that those who have been least favored with the bounties of civilization have the best teeth.

Speaking about the effects of civilization, Aulus Cornelius Celus, the famous Roman physician of the first century, makes the following statement[24]:

> It is probable that in ancient times, although there was but little knowledge of medicine, health was for the most part well preserved, this being due to good habits not yet spoiled by intemperance and idleness. These two vices, first in Greece and then among us, have brought upon us a very host of evils. Hence, it is that in our day, in spite of the intricate art of medicine once not necessary to us (as it is not necessary to other peoples), few among us attain the beginning of old age.

A perfect picture of our own situation, and one that needs no comment.

Nineteen centuries later, the English philosopher and author Edward Carpenter, in his book "Civilization, Its Cause and Cure,"[25] seems to hold that all bodily ills are products of civilization:

> Disease is applicable to our social as well as to our physical condition, for as in the body, disease arises from the loss of physical unity which constitutes health, and so takes the form of warfare or discord between the various parts, or of the abnormal development of the individual organs, or the consumption of the system by predatory germs and growths; so in our modern life we find the unity gone which constitutes true society, and in its place warfare of classes and individuals, abnormal development of some to the detriment of others and the consumption of the organism by masses of social parasites. If the word disease is applicable anywhere, I should say it is—both in its direct and derived sense—to civilized society of today.

Describing civilized society, he says further,

> He who had been the free child of nature denies his sonship. . . . He deliberately turns his back upon the light of the sun, and hides himself away in boxes with breathing holes which he calls houses. . . . He muffles himself in the cast off furs of the beasts, every century swathing himself in more and more layers, more and more fearfully and wonderfully fashioned until he ceases to be recognizable as the man that was once the crown of the animals. . . . He ceases to a great extent to use his muscles; his feet become partly degenerate, his *teeth wholly*, his digestion so enervated that he has to cook his food and make pulp of all his victuals.

DISUSE ATROPHY

In this mad search for the cause of dental caries, it seems that there is one thing that we have almost lost sight of: In the animal kingdom, the human species is the only one that suffers from dental disease—all the rest are immune. And, as before stated, it is almost impossible to produce the disease without killing the laboratory animal. The primary function of teeth is to prepare the food in its natural state for digestion and assimilation. With the exception of man,

21. Magitot, Emile, and Legros, Charles: Contribution a L'etude du development des dents. Origine et formation du follicule dentaire ches les mammiferes (translation from the French, with introduction and notes by M. S. Dean), Chicago: McClurg, 1880. Pickerill, H. P., Footnote 17. Marshall, J. S.: Operative Dentistry, p. 130.

22. Mummery, J. H.: Microscopic and General Anatomy of Teeth, Human and Comparative, Oxford Medical Publications, 1847; Tr. Odontol. Soc., 2, new series.

23. Patrick, in Pickerill, Footnote 17. Marshall, J. S., Footnote 21, p. 131.

24. Footnote 1, p. 81.

25. Carpenter, Edward: Civilization—Its Cause and Its Cure, pp. 2 and 3.

this function has been maintained in the animal kingdom throughout the ages. If the teeth gave out, it would mean the extermination of the species. As far as I know, there is no such case on record.

History tells us that as man advanced in civilization, the culinary art was one of the first to be developed. We are told of the great banquets in the Egyptian palaces where the most delicate courses were served on golden platters. You all know the culinary competition between Mark Anthony and Cleopatra.[26] The teeth of the aristocracy of Egypt and Rome were relegated to the ranks of the unemployed, and began to decay. The story of the development of the culinary art in civilized society should be of interest to research workers in dentistry. We have not time to dwell on it here, but if we take a glance at the foods on the American table—the breakfasts, the lunches and the dinners—we soon become convinced that they do not tax the muscles of mastication.

Let us not forget that we are dealing with the laws of nature. When human beings were using their teeth and were dependent on them for existence, Nature furnished them unstintingly. There was no caries and no pyorrhea. But as the teeth were relieved of their natural function, Nature withdrew its support, decay and pyorrhea set in, and jaws grew smaller, so that the normal complement of teeth cannot be accommodated any longer. The laws of nature belong to no political party; they cannot be twisted or declared unconstitutional. They follow strictly the principle of supply and demand. Addition of vitamins and prophylactic measures seem to have had little effect.

I wish to emphasize, in conclusion, that I am not suggesting that we should abandon the toothbrush and stop caring for our teeth—by no means. In our civilized society, oral hygiene is more important than ever. Nature's way of cleaning teeth was left in the jungle, and we cannot recover it. The road to prevention of dental diseases seems to point to primitive living, where teeth should have to resume their normal activity. It is rather too much to expect science to perform the miracle of altering the laws of nature. Science, as a rule, does not work that way. If, as civilized people, we do not choose to abandon the flesh pots of Egypt for life in the jungle, we must do the next best thing: seek the service of dentistry. And honest dentistry, with its mechanical ingenuity, has rendered yeoman service in relieving suffering society in this most common of all diseases. If orange juice and cod liver oil and toothbrushes have failed to prevent dental caries, dentists have at least saved teeth by the millions by the simple operation of filling small cavities. Many more millions of teeth can be saved if dentistry is permitted to render service to its full capacity.

It is my opinion that this is the question of importance for dentistry today.

DISCUSSION

Charles F. Bödecker, New York City: The statistical material presented by Dr. Brekhus is a distinct contribution to dental literature. His warning that dental caries is increasing at an alarming rate is timely, even though the increase may not be quite so great as his figures indicate. The title "Civilization—A Disease," is pithy and linked closely with dental caries. This connection has been demonstrated recently by Waugh in his observations of the Eskimo. Dental caries follows the introduction of grocery store foods. The statistics compiled by Dr. Brekhus show much interesting data; the most startling is the marked increase of caries in this century. It is far from my purpose to create the impression

26. Guerber, H. A.: Story of Romans, New York: American Book Co., p. 195.

that dental caries is decreasing. On the contrary, the teeth of each succeeding generation seem to become poorer, unless the children receive special attention as to diet. The increase of caries shown by the figures of Dr. Brekhus seems extreme, and two suggestions will be advanced that may make these amazing observations more comprehensible. One of these tends to show a possible reason that caries is increasing; the other indicates that the caries increase probably is not so great as it would seem from the figures quoted here. Dr. Brekhus infers that as caries is increasing markedly in the 10-20 years group (3 per cent of sound molars as against 23 per cent in the 41-50 year group), vitamins are valueless in preventing decay of the teeth. I wonder how many persons of this clinic group, on which the observations were made, are really under the supervision of a dietitian and obtain a well-balanced diet with an abundance of vitamin D. Unless this group is radically different from the rest of the population of the United States, it seems that their diet would include the usual highly refined foods. It is probable also that a certain percentage of children would indulge in "lollypops," thus bathing their teeth for a long time in a solution of sugar. The inference, therefore, that vitamins are valueless in protecting the teeth does not seem to be borne out by these observations. And now to the second explanation, which indicates that conditions in the younger and the older groups, 10-20 and 41-50 years, are not comparable with their 3 per cent and 23 per cent of sound teeth. Two diseases result in the destruction of the dental organs, i.e., caries and pyorrhea. Caries is most active during youth, up to 30 or 40 years; after this, pyorrhea often sets in. The persons composing the 10-20 years group evidently suffered from a high activity of dental caries as indicated by their having only 3 per cent sound first molars. Further, it is a common clinical observation that persons who develop extensive dental caries during youth are not afflicted by pyorrhea. Hence, the members of this young group, with their large percentage of carious teeth, are not included in the later life groups. On the other hand, the persons making up the 40 to 60 year groups usually consult their dentist for treatment of pyorrhea, and these persons usually have suffered little from dental caries. Hence, it is natural that the examination of such pyorrheic mouths shows a much higher percentage of sound teeth. It is clear, therefore, that the persons composing the young and old groups suffer from two different dental diseases, the first having caries-ravaged teeth (not represented in the older group), and the second, more sound teeth. (In other words, the type of patients is different in the two groups.) Consequently, a comparison of these groups gives the impression of an undue increase of dental caries in the younger generation. It may be possible therefore that dental caries has not increased quite so much as the figures of Drs. Brekhus and Armstrong indicate. I am emphatic in my belief that tooth decay is increasing to a certain extent. This is indicated by Dr. Brekhus' figures on the two youngest groups. These are more comparable. A few words concerning vitamins. It seems that there is sufficient evidence furnished by a number of investigators that vitamin D is beneficial to the teeth. Dr. McBeath showed, among other observations, that the size of the dose of vitamin D concentrate was in direct ratio to the degree of reduction of dental caries. Doses of 300 units were more effective in reducing dental caries than doses of 150 or 100 units per day of this concentrate. This is sufficient proof that a deficiency of vitamin D is a major factor in dental caries; at least, in certain localities. But, like all new discoveries, it is possible that the rôle of vitamins and balanced diets in relation to dental health has been exaggerated. It is probable that other factors enter into the cause of dental caries, such as endocrine disturbances and the hereditary taint of poorly calcified teeth. Ill-effects on the teeth of this kind cannot be counterbalanced solely by diets or vitamins. Nevertheless, the dental conditions of many persons can be improved greatly if they will follow proper medico-dental instruction.

TECHNIC OF ORTHODONTIC APPLIANCE CONSTRUCTION USING CHROME ALLOY METALS*

By WILLIAM R. HUMPHREY, D.D.S., Denver, Colo.

THE student of orthodontia who masters a technic of appliance construction using stainless steel, or chrome alloy as the newer metal is popularly known, finds himself engaged in a profitable, fascinating and revolutionary endeavor; but before taking up any new technic, the student should fortify himself by reviewing the errors and successes of other workers in the field.

Those contemplating appliance construction using chrome alloy should read the published work of de Coster,[1] Friel,[2] Brusse and Carman.[3] I have borrowed freely from these men in developing the technic that I have been using for nearly two years, and while I still have difficulties, many have been eliminated. The true value of a material must be proved in actual practice in the hands of many operators possessing different methods of procedure, and as more men take up the use of chrome alloy and report their experiences, the sum total of this information should tend to the development of a good technic.

Some of the first metals used corroded and broke down, owing, no doubt, to the fact that they were not properly balanced alloys. An extensive treatise contributed by the U. S. Steel Corporation Research Laboratories by E. C. Bain, R. H. Aborn, and J. J. B. Rutherford,[4] will answer a great many questions in the minds of the users of steel alloys. Undoubtedly, the corrosion or breakage in the appliances, both bands and arches, which occurs at spots where the metal has been united, is due to the heating of the metal in welding. In the abovementioned treatise, it was found that

> . . . metal after exposure to moderated temperatures in the general vicinity of 1,000 to 1,500 degrees Fahr., has been frequently found to be subject to a very characteristic form of inter-granular corrosion even in the environments which ordinarily have no effect on the normal alloys. Thus the metal near a weld sometimes becomes literally disintegrated.

The metal that I now use, both for band metal and arch wire, is called U. S. 18/8 balanced alloy.

I am not possessed with a knowledge of metallurgy sufficient to discuss the technic employed in stabilizing these metals. The process of stabilizing stain-

*Read before the Section on Orthodontia at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 7, 1935.

1. De Coster, Lucien: Use of Rustless Steel in Dentofacial Orthopedics, Internat. J. Orthodon., 18:1191 (Nov.) 1932.

2. Friel, Sheldon: Practical Application of Stainless Steel in Construction of Fixed Orthodontic Appliances, Internat. J. Orthodon., 20: 972 (Oct.) 1934.

3. Brusse, Archie, and Carman, J. L.: Chrome Alloy, Internat. J. Orthodon., 20:337 (April) 1934.

4. Bain, E. C.; Aborn, R. H., and Rutherford, J. J. B.: Nature and Prevention of Intergranular Corrosion in Austenitic Stainless Steels, Tr. Am. Soc. Steel Treat., 21:481 (June) 1933.

less steel is accomplished by the addition to the chrome alloy of certain elements, such as titanium. Since the whole subject of producing a proper metal for our use is important, the careful reading of the preceding treatise is advisable.

The metal possesses many physical properties that are vital to the construction of orthodontic mechanism. In its softened state, the band material used for anterior teeth, which is 0.17 inch in width by 0.003 inch in thickness, will stretch one-eighth its length before parting. The band material for molar bands, which is 0.20 inch in width by 0.006 inch in thickness, will stretch one-fourth its length before parting. Since the metal is so malleable, it is possible to fit the contours of the teeth and reproduce the dental structure. This metal cannot be hardened by heat treatment and is tempered by drawing through a draw-plate, by rolling or by manipulation. This characteristic in the metal makes it particularly suited to band technic, because, as the band nears completion in its contoured state, it possesses a certain degree of temper, from manipulation of the metal, which prevents distortion from stresses, those exerted both by the appliance and in mastication. I have had fewer loosened bands since I adopted this technic. The metal possesses unusual elasticity and strength, which permits the use of smaller diameter arch wires and auxiliary springs. It is safe to say that one can use a wire from one-third to one-half the diameter of a gold platinum wire.

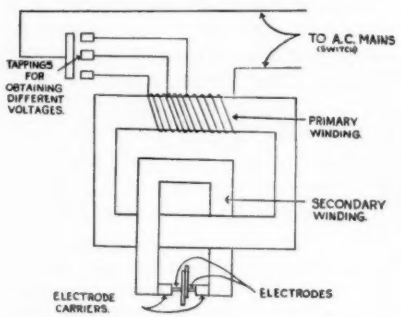


Fig. 1.—Diagram of step-down static transformer, which reduces 110 or 250 line voltage, as case may be, from one-half to two volts with amperage output up to 1,000 amperes.

Before taking up the steps in the technic, I must remind you that any material lends itself to the hands of the craftsman in two ways: it can either be crudely worked, or it can be fashioned into a thing of beauty. This material is extremely hard and takes a particularly high polish, and since it does not oxidize during mouth digestion and in the presence of food acids, it remains bright and clean throughout the treatment.

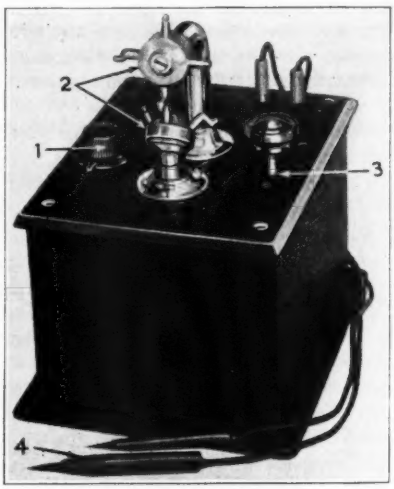


Fig. 2.—Turret-head spot welder, electrodes of which can be quickly adapted to various types of work.

The use of solder for uniting the various parts of my appliances has been

abandoned, the process of resistance welding popularly called spot or shot welding being now employed exclusively. Figure 1, a diagram taken from Friel's paper and adapted from Wilson's "Electric Welding," shows a step-down static transformer, which reduces the 110 or

Fig. 3.—Welder mounted on shelf bracket with compound lever. When the welder is thus mounted, the amount of pressure required to open the electrodes is reduced.

250 line voltage, as the case may be, to a lower voltage, which will be two volts or less, sometimes as low as one-half volt, with an amperage from 500 to 1,000 amperes. In order to acquire a working knowledge of resistance welding, I would advise reading several of the published textbooks on electric welding.[5]

I am using the turret-head spot welder (Fig. 2). This welder possesses several advantages over many other welders on the market in that there are four sets of electrodes that are quickly interchangeable; and as the shape and form of the electrodes are one of the most important points of a successful technic, the turret-head is indispensable. A great many failures in the welding of chrome alloy are due to the use of improperly shaped or corroded electrodes, a subject that will be covered as the various steps in the construction of the appliances are discussed. Figure 3 shows my method of mounting the spot-welder, on shelf-brackets with a rod connected to a small pedal attached to the baseboard. The method of mounting the welder will have to be worked out to fit each location. I find that by using a compound lever, as illustrated, the pressure required to open the electrodes is decreased and the apparatus works more efficiently.

The construction of bands will be divided into three types: those for the incisors; those for the teeth of greater convexity, the cuspids and bicuspids, and, lastly, the molar bands. In constructing the incisor bands, the labial pinch is used (Fig. 4, *1* and *2*). This permits the metal to be burnished on the lingual surface and closely adapted on the lingual incisal border, the metal being stretched tightly at the mesial and distal incisal angles, and the unsightly ears that are

5. Horner, H. A.: Spot and Arc Welding, Philadelphia: J. B. Lippincott Co., 1920. Hamilton, D. T., and Oberg, Erik: Electric Welding, New York: The Industrial Press, 1919. Carpmael, Herbert: Electric Welding and Welding Appliances, London: Constable & Company, Ltd., 1920.

often seen on anterior bands eliminated completely. At *3,* the band is ready to be removed from the tooth and trimmed. The metal is trimmed at the angle made by the pinch on one side and on the other side 1 mm. of excess is turned down and lapped over and welded as in *4,* above. The attachment of choice is then welded across the seam as in *4,* below. The lingual pinch shown at *5* is not used because I have not been able to get an adaption to the lingual surface that satisfied me. There is usually a small v-shaped place left in a most vulnerable area.

In constructing the cuspid and bicuspid bands, the following technic has a decided advantage. Figure 5 (*1*), left, is a plain cylinder welded with a spot midway between the top and bottom of the cylinder. The cylinder is then contoured by pliers (*2*). This allows the metal to lap as is shown below (*3*), a contoured tube resulting, and the welding is then completed. The same plan applied to the construction of a mandibular bicuspid band is shown on the right from top to bottom: the pinch (*1*), the single-welded spot (*2*), the contouring (*3*) the finished and contoured band at the bottom (*4*).

Before taking up molar bands, I wish to refer to an illustration (Fig. 6) that I used in a clinic given before the American Society of Orthodontists in 1927, entitled "Studies in Dental Anatomy Which Relate to the Fit of Bands."[6] On the left are plain bands placed over a mandibular and maxillary molar standing in a vertical plane. On the right are properly contoured maxillary and mandibular molar bands fitted to molars, standing in their true axis. It is a comparatively easy matter to draw pictures of molar bands fitted as they are in this illustration. It is quite another matter to adapt metal to a tooth as they appear on the left. An established fact is that the circumference at the gingival aspect of the molars is less than it is at the contact point. Therefore, the bands, in order to be adapted, must be fitted diagonally across the tooth, as illustrated on the right. In this way, the gingival and occlusal circumferences of the band are more nearly equal. Also, the band metal is carried down on the buccal aspect of the mandibular molars and up on the

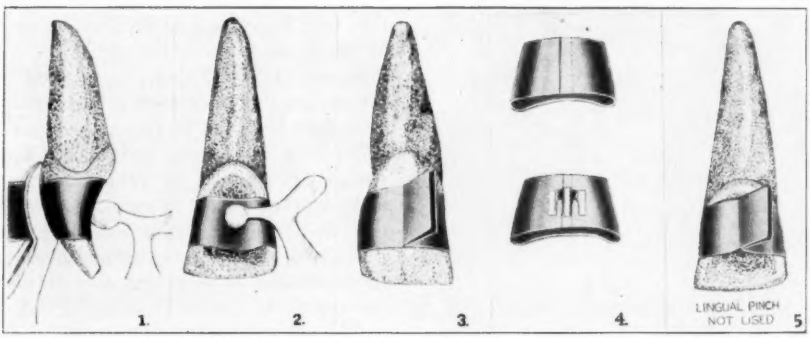


Fig. 4.—Technic employed in constructing bands for incisors. The amount of metal lapped for spot-welding is to be noted.

6. Humphrey, W. R.: Studies in Dental Anatomy Which Relate to Fit of Bands, unpublished data.

lingual of the maxillary molars in such a way that the stress of mastication does not fall on the edge of the band material.

During the past few years, there has been a great deal of attention paid to the study of dental anatomy in relation to the fit of bands. One of the most progressive pieces of work was conducted by Drs. Brusse and Carman, the result of

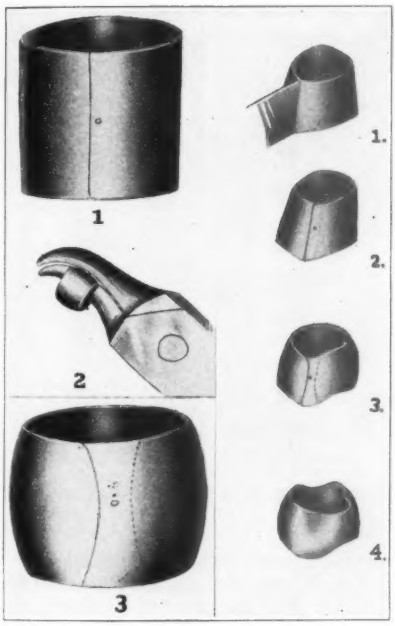


Fig. 5.—Technic used in construction of contoured bands for cuspids and bicuspids.

which was a set of twelve maxillary and twelve mandibular first molar dies over which properly contoured seamless bands are manufactured. This, together with their anatomic band stretcher (Fig. 7) can also be secured through a metal products company. To my mind, these bands are the most nearly anatomically formed of all that have come to my attention. It is rarely necessary to cut and lap these bands to get a good result. If one wishes to make molar bands from straight band material, the technic illustrated in Figure 5 may be employed.

In fitting seamless molar bands, I select a band that is slightly smaller than the tooth, and then very gradually contour, festoon and stretch the band, always putting the mandibular bands down on the buccal aspect, which tightens them against the lingual aspect, and carry the maxillary bands up on the lingual aspect, which tightens them against the buccal. It has been routine practice to

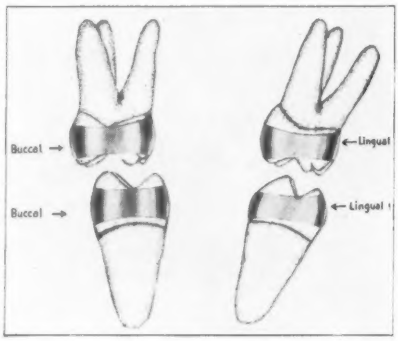


Fig. 6.—Left: Wrong position for molar bands. Right: Correct position for molar bands.

roentgenograph these bands after fitting, and we find them excellently adapted.

The attachments to the bands that I am using (Fig. 8) consist of (1) the buccal tube; (2) the channel bracket, which is a tie bracket; (3) the Ketcham hook, and (4) the lingual tube for the Ellis lingual arch. I use principally labial arches, banding the incisors, cuspids, bicuspids and first molars, and a very small diameter labial arch, from 0.018 to 0.022, depending on the character of the case. Since it is difficult to weld inter-

maxillary hooks and attachments to these very small diameter wires without removing some of the temper, I bend in the intermaxillary hook and using a stop anterior to the molar band (Fig. 9). The intermaxillary hook is bent into the wire without removing the temper. The steps are shown in Figure 9. The pliers shown at *5* were constructed by removing the temper from ribbon arch wire pliers, a hole being drilled through one beak and the other beak contoured to press the hook together and draw it up as shown in the illustration. The pliers were then retempered.

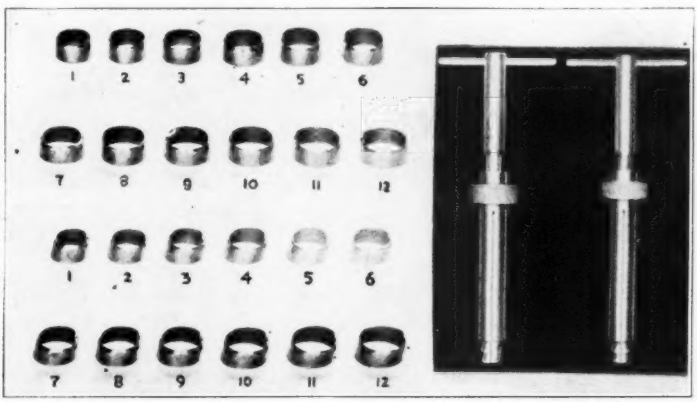


Fig. 7.—Set of twelve contoured maxillary and mandibular seamless bands with anatomic band stretcher.

In constructing the lingual arch, the technic developed by Brusse and Carman is used. The various steps are illustrated in Figure 10. The steps, which I quote from their technic, are as follows:

A piece of 0.036 or 0.032 wire is annealed approximately 2 inches from the end of the wire at *A*. The Ellis wire bending pliers (Fig. 10, right) are used to squeeze the wire all the way together *(B)*. Grasp the bent section with the pliers approximately one-tenth inch from the end and force the long end of the wire at a right angle *(C)*. Holding the wire firmly with pliers, bend the short end to a straight angle *(D)*. Place the resulting loop *(D)* in the hole of the Ellis bending pliers to establish depth of loop. Then place loop in Ellis type tube on left side of model. Adapt the arch to approximately the position desired. Grasp arch with hemostat mesial to tube on right side. Anneal wire posterior to the beaks of the hemostat. Then place beak of Ellis pliers back of the hemostat, release hemostat and bend wire upward and backward upon itself.

To complete the post or loop, repeat the operations as described for the construction of the loop on the left side of the arch. *F, G* and *H* in the illustrations show these operations on the right side.

The greatest difficulty experienced in constructing appliances of chrome alloy has been in the welding of small diameter wires to those of larger diameter. Since studying Friel's paper, I have been able to correct many errors in technic and wish to give Friel's explanation of the reason and the solution for the difficulty that we have all experienced in attaching a wire of smaller diameter such as an auxiliary spring, to an arch wire. In

Figure 11 are shown three illustrations from Friel's article as published in the *International Journal of Orthodontia.* It is the most vital point in the construction of appliances wherein small wires must be attached to those of larger diameter. To quote from the text:

In Figure 11, *1,* if the two wires are arranged in an electric circuit in such a way that current must pass from one to the other, it is obvious that its path, the point where they touch, is very minute, and so offers an extremely high resistance compared to the thick electrodes of high conductivity material. This means that the heat at that point will be correspondingly high, with the result that the surfaces in contact will fuse, and if there is pressure on them, will unite. There is an additional factor here helping to concentrate the heat at the one point, namely that resistance is highest at the surface of the material, owing to oxidization.

We have to take account of three other factors influencing conditions in the welding area. First, conduction of heat. If current continues to flow through the wires, the heat will spread from the contact points, resulting in softening and eventually deformation of the wires. Obviously, then, current should only flow for sufficient time to allow the surfaces to fuse, but that time will depend on the weight of current flowing, so we get the rule to use the maximum current for the minimum time. In practice, there is a limit to the quickness even of an automatic switch, but the rule should be observed as far as that limit will permit.

Second, it has been stated above that pressure completes the weld, but to avoid deformation of the heated metal that pressure should be kept to a minimum. Pressure also requires to be maintained until the weld has cooled, in practice a very short time.

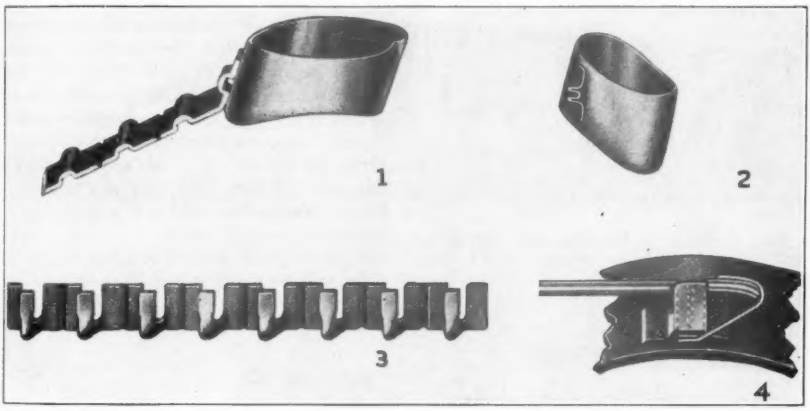


Fig. 8.—Types of attachments used: *1,* buccal tube; *2,* tie bracket; *3,* hook; *4,* lingual tube for lingual arch.

(I follow the plan of counting 1-2-3-4, then removing the work from the welder.)

The third factor in the welding area is that the manner in which the electrodes make contact with the wires has considerable influence on the nature of the weld. The place to apply the electrodes is at *E1, E2,* Figure 11, immediately opposite the contact points, as not only can we then apply pressure through the electrodes, but we have the current passing through and

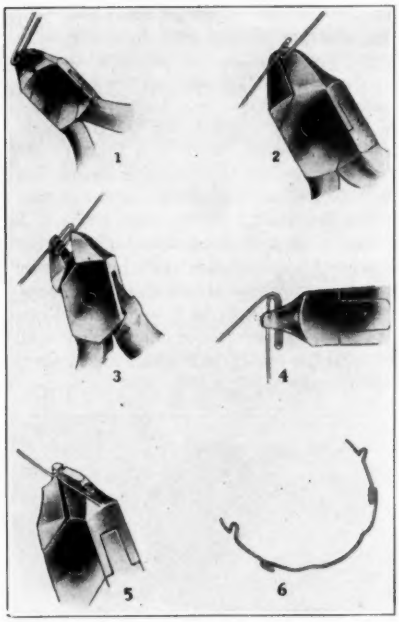


Fig. 9.—Steps in bending hook for intermaxillary rubbers in construction of one-piece labial arch shown in *6*.

Figure 11, *2, A* and *B,* shows the paths of current flowing through a joint from pointed and broad electrodes respectively. With pointed electrodes the current is more concentrated, so that for the same current and time we get a greater heat and a better weld; and if we were always welding parts of equal section we would always use pointed electrodes, the actual shape of the point being largely governed by the mechanical strength of the electrode material. It will be noted that where contact occurs between eelctrodes and parts to be welded, conditions of high resistance occur, so that there is some heating of the surface, but it is less than between the two parts owing to the higher conductivity, both of electricity and heat, of the electrodes. To keep this heating to a minimum it is necessary that the electrode points should be free from oxidization. But the different conditions existing when two parts of widely differing sections are to be welded require some modification of this contact form. In Figure 11, *3, A,* an example of this sort is shown. The area of a thin wire fuse in making the weld is in any case proportionally greater than in a thick wire; also for a given current welding temperatures will be reached in a shorter time, so

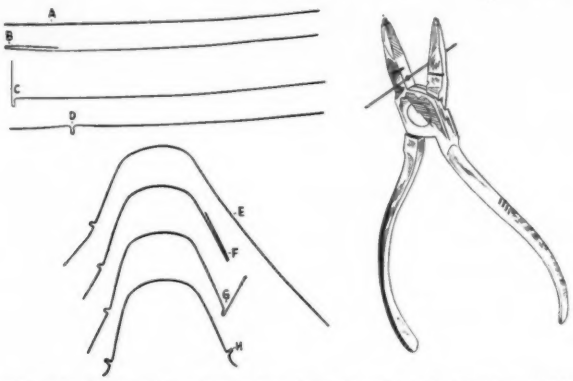


Fig. 10.—Steps in construction of one-piece lingual arch, and pliers for making bends.

so heating the minimum of high resistance material. In addition, the area of contact is important.

that by the time the thicker wire has reached welding temperature conducted heat will have softened the whole of the

thin wire, allowing it to deform under the pressure. But if we apply to the thin wire an electrode that makes with it a larger area of contact (Fig. 11, *3, B*), the current will be more dispersed, the resistance less, and the time taken to reach welding temperature consequently equalized with that of the thicker wire.

These are the extreme conditions, and the contact areas required for other kinds of joint are readily deducible from them.

It may be useful to point out that it is for joining two relatively thin parts that the voltage control is required, and for the reason that the dwell of the switch is so long, even at its minimum, to fuse excessively the materials with the full current. The reduced current requires a longer time to achieve welding temperature, and so brings that time within the compass of the switch.

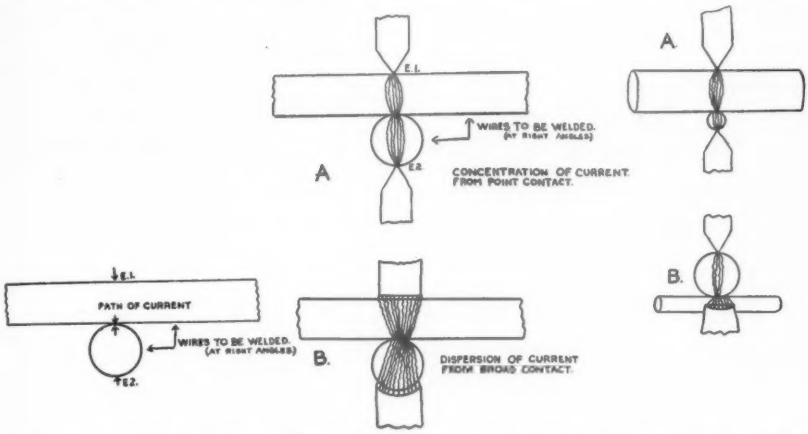


Fig. 11.—Diagram showing steps necessary for attaching small diameter wire to one of larger diameter.

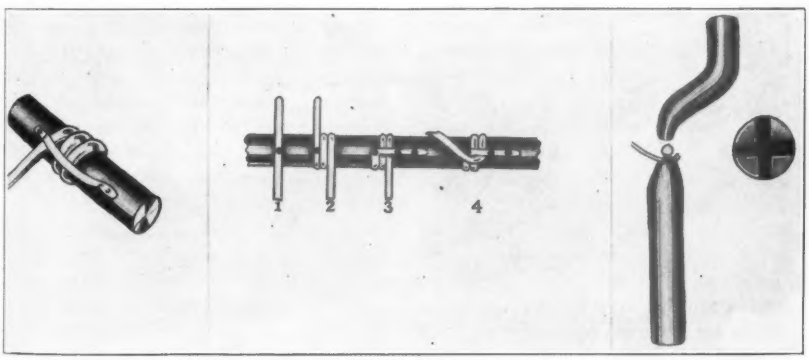


Fig. 12.—Procedure followed in attachment of auxiliary springs to main arch wires.

In attaching the auxiliary springs I use a half-hitch method that was originated

by Friel, and improved by Brusse and Carman as illustrated in Figure 12, Friel's original method on the left (*1*), Brusse and Carman's method of the half-hitch in the center (*2*). The wire is lightly tacked on in step 1 at the left. The auxiliary wire must be buried in the electrode and the ball contact of the other electrode allowed to touch the larger wire, which rests on top as shown in *3*. This is important, as has just been described in the explanation of the shape of the electrodes. The auxiliary spring is then given two turns about the base wire. The smaller free end is turned back at right angles over the coil and welded as shown at *3* in *2*, Figure 12. The wire that is to be an auxiliary spring is then pulled forward against the hitch, the attachment being completed as at *4*.

No attempt has been made to discuss the treatment of malocclusion; neither has the construction of every conceivable form of appliance been covered. Enough of the fundamentals have been given for those wishing to adopt this technic to vary it according to their needs. Mention should be made of the fact that a technic using chrome alloy metals can be adapted to any treatment procedure. In the use of this new material, there is opportunity for the expenditure of creative ability and the metal will, I believe, advance the study of orthodontics.

SURGICAL TECHNIC FOR REMOVAL OF IMPACTED AND HYPERCEMENTOSED TEETH*

By JAMES A. BLUE, D.D.S., F.A.C.D., Birmingham, Ala.

THE necessity for properly handling soft tissues in the mouth is evident. The technic for removal of teeth does not fall within the scope of this discussion, but the subject will be touched on lightly.

A flap for any operation should be of such design that when it is detached from the bone, it forms an opening of sufficient length and breadth to furnish easy access to bone and tooth and the diseased periodontal tissue that is to be removed.

Flaps for impacted or unerupted mandibular third molars should begin midway between the distobuccal and distolingual angles of the second molar, extending distobuccally, following the curvature of the bone in this region to the ascending ramus, and thereby avoiding disturbance of the lingual tissues. The gingival tissues are elevated from the buccal surface of the second molar to the mesiobuccal angle. This procedure affords sufficient access to the bone on the buccal side and allows the flap to be retracted with undue strain and prevents tearing and laceration. The tissues along the lingual border of the bone are carefully elevated, extending forward sufficiently to expose the distolingual angle of the second molar. The necessary bone is removed and the tooth is elevated from its socket. The bone should then be inspected for rough or sharp margins, which should be made smooth. The flaps

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

are then apposed and sutured, one suture usually being sufficient. A use of a flap of the foregoing design, if properly handled, prevents excessive trauma, as the

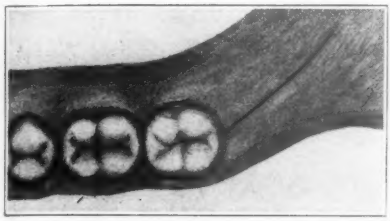


Fig. 1.—Incision following long axis of impacted molar extending buccally and mucoperiosteum freed from gingival margin of second molar.

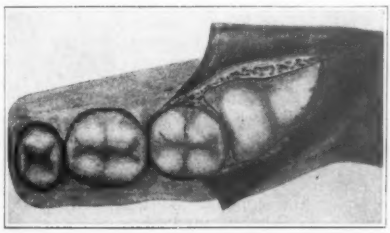


Fig. 2.—Elevation of mucoperiosteum to afford access to interfering osseus structure, which has been removed sufficiently to permit removal of tooth.

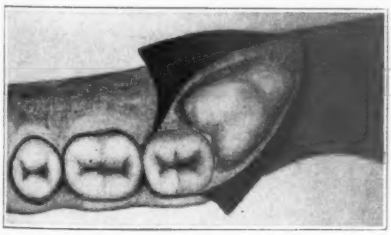


Fig. 3.—View similar to that shown in Figure 2, but with more pronounced buccal inclination. There is a free opening of the buccal flap.

lingual tissues have not been cut or unduly lacerated. The buccal side is protected by the buccal flap, which prevents an opening at the distobuccal angle of the second molar, so often occurring if incisions are made in a haphazard manner. (Figs. 1-3.)

REMOVAL OF MAXILLARY THIRD MOLARS

When an upper third molar is to be

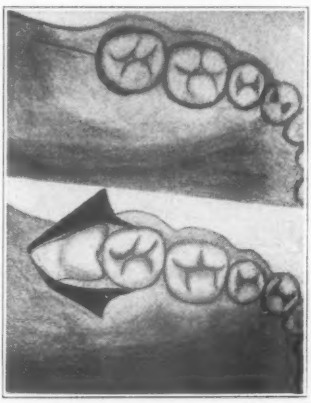


Fig. 4.—Above: Incision preparatory to retraction of flaps. Below: Tissue retracted exposing tooth and bone.

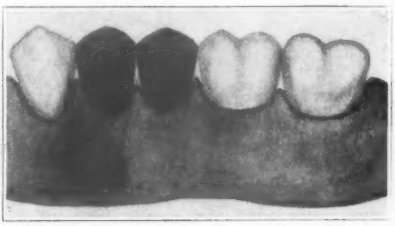


Fig. 5.—Incision for removal of two bicuspids and small cyst.

removed, the incision should begin midway between the distobuccal and distopalatal angles of the second molar, extending distally into the fold as far as possible. The mucoperiosteum is then stripped from the bone buccally sufficiently that there is free access to the

tooth which is to be removed. Then the tissues are elevated toward the palate, more buccal elevation than palatal elevation being necessary. A good sense of touch and proper instruments are all that is usually needed for the average unerupted maxillary third molar. (Fig. 4.) When this tooth is deeply impacted, the

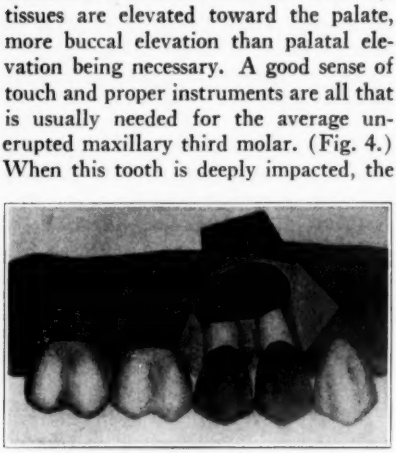


Fig. 6.—Retraction of mucoperiosteum and removal of bone from buccal surfaces of roots and cyst.

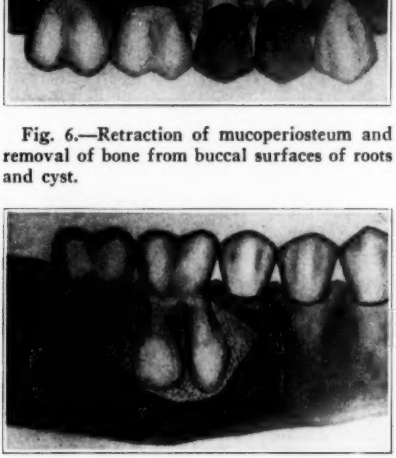


Fig. 7.—Open view of lower first molar with hypercementosed roots exposed. The tooth should be removed buccally.

tissues along the buccal side may be elevated far enough forward to enable the operator to visualize the entire operative field. After the removal of the tooth, the tissues are put in apposition and one suture is all that is necessary.

The flap for the removal of hypercementosed teeth, roots and infected and cystic areas should begin at the mesiobuccal or labial angle of the tooth to be removed and extended upward and forward, or downward and forward, this depending on whether the operation is for an upper or a lower tooth, to a point opposite the eminence of the tooth anteriorly from the one to be removed, then posteriorly from the mucous fold, a definite angle resulting. This angle is important as a guide to the accurate replacement of the flap. The mucoperiosteum should be stripped from the bone with as much accuracy as possible to prevent trauma. A number of teeth may be included in this operation, provided they are distad from the anterior in-

Fig. 8.—Above: Left, gingival tissue on buccal side of molar. Right, buccal side of molar after removal of tissue. Below: Left, lingual side before operation. Right, lingual side after operation.

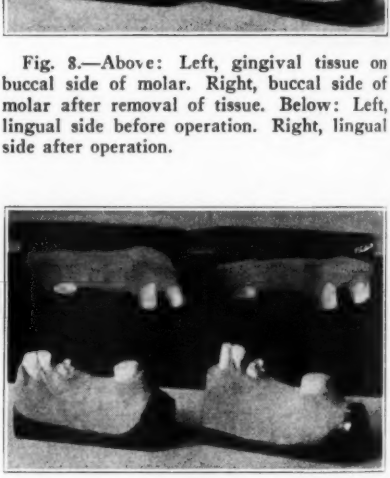


Fig. 9.—Upper second molar and lower first bicuspid before and after removal of excessive gum tissue. A small amount of bone was removed in each case.

cision. The posterior portion of the flap may be elevated from the buccal surface of the tooth distad from the field of operation. The above-described flap applies to all teeth except the central incisor, on account of the frenum labii, in which case the reverse is advisable. After operation, this flap should be placed in position accurately to prevent scarring, and sutured securely in position. (Figs. 5-7.) In many cases, teeth to be used for bridge abutments are partially submerged. In some cases, the soft tissues cover half of the coronal portion of the tooth. In some instances, an attempt has been made to grasp the exposed cusps with a band or an inlay, resulting in failure. B. F. Sapienza, of Birmingham, called my attention to this fact about two years ago and suggested that a technic for the removal of this interfering gum tissue be worked out to enable him to obtain a sufficient grasp with a cast crown to afford support for bridges. The first step is to make a roentgenogram of the tooth to determine the distance from the gingival margin to the bone, the condition of the pulp and the length of the root or roots. The soft tissues are then removed to the bone margins, buccally and lingually. V-shaped pieces of tissues are removed from the distal and mesial aspect, the ulcerated tissue being removed from the bone and the neck of the tooth. The tissues are then sutured buccolingually, and a ring of surgical paste is placed around the tooth and allowed to remain ten days or two weeks; at which time, healing has taken place. Many of these teeth have drifted forward and present a diseased area at the mesial surface. This should be cut away and curetted to the depth of the crevice and the surgical paste carried to the bottom of the pocket, as well as completely around the tooth. (Figs. 8-9.)

R. L. Houston, of Birmingham, is meeting with success in cases wherein cavities extend under the gum margin. The soft tissue is cut away to a point beyond the margin of the cavity to enable the operator to finish the filling properly and to prevent future irritation. When this procedure is followed, a healthier and more satisfactory gingival margin is assured.

DIAGNOSIS AND TREATMENT OF VINCENT'S INFECTION*

By JOHN H. NESSON, D.M.D., Boston, Mass.

THE first knowledge of the stomatitis now commonly known as "trench mouth" and the fusospirochetes comes from the early discovery of these organisms in 1894 by Plaut, and in 1896 by Vincent. They isolated the fusospirochetes in pathologic conditions now recognized as Vincent's angina. They were followed by numerous investigators during the next ten years, but it was not until 1906, when Schaudinn discovered *Treponema pallidum,* that renewed efforts were made to study and isolate the fusospirochetes.

During the ten years that followed this remarkable discovery by Schaudinn,

*Read before the Maine State Dental Society, Augusta, June 23, 1934.

little was heard about Vincent's infection. Prior to the World War, we were taught that it was one of the rare diseases of the mouth, whether it was called trench mouth or by one of the thirty-six synonyms under which I have classified this disease. At school, we were taught little about the etiology and less about the treatment. Shortly after the outbreak of the World War, we began to hear about epidemics of this disease among the soldiers on the various battle fronts.

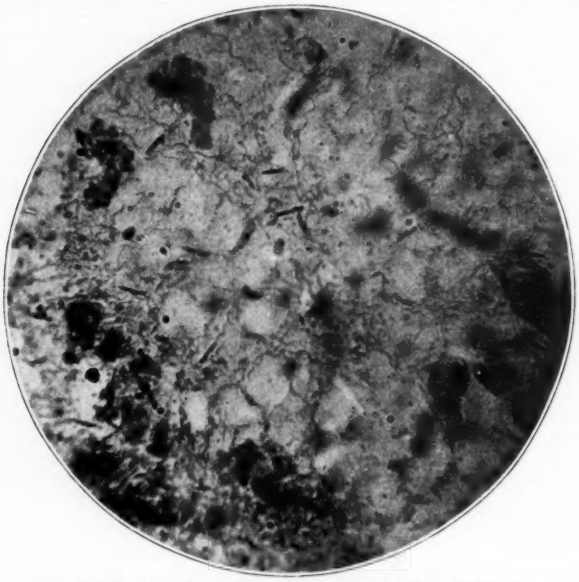


Fig. 1.—Photomicrograph of smear made in Vincent's infection. There is a preponderance of fusospirochetes, with various types of spirochetes and two types of fusiform bacilli.

In the U. S. Army, Colonel Dunham, although he termed the disease Vincent's angina in his book and official reports, recorded the primary admission of 6,189 cases of trench mouth, with a consequent loss of 92,690 duty days. With the return of the military forces to civilian life, we began to see these cases in private practice.

Because of the great confusion that exists as to the etiology and treatment of Vincent's infection, I will endeavor to clarify these phases.

Without pointing out the misconceptions that exist, let us turn to the symbiosis of organisms involved in this condition. These consist of a group of anaerobic spirochetes, fusiform bacilli, spirilla and vibriones. I have classified twenty-one synonyms for the organisms in this symbiosis. Contrary to popular belief, there are more than one spirochete in this group. First in the group is *Borrelia vincenti,* often erroneously termed the spirochete of Vincent, or Vincent's spirillum. There are many other spirochetes in this symbiosis, the most important being: *Treponema buccale, Treponema macrodentium, Treponema microdentium, and Treponema mucosum.* The latter two are the organisms that are responsible for the putrid

odor of Vincent's infection. There are at least two types of the fusiform bacillus, one a long and the other a shorter club-shape rod. Besides, there are numerous spirilla and vibriones. It is impossible, even for a trained bacteriologist, to differentiate these various spirochetes as they appear on a smear. Only by a differential diagnosis of their respective motilities with the dark-field illumination and by biochemical tests can they be distinguished.

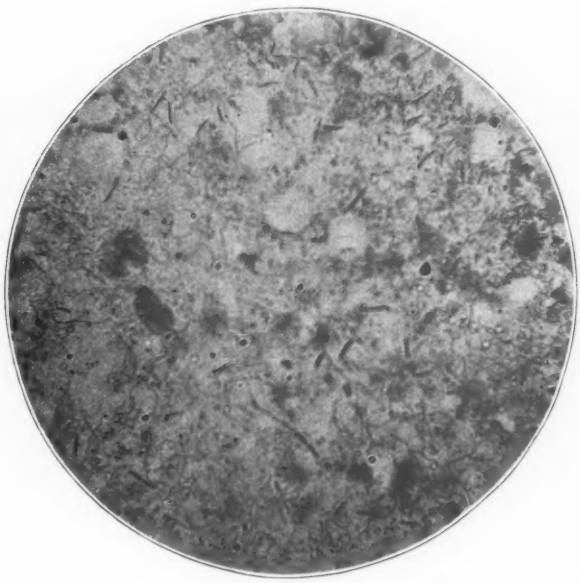


Fig. 2.—Photomicrograph of smear made in case of chronic gingivitis. The fusospirochetes predominate in the field and the smear resembles one made in a case of Vincent's infection.

In addition to this symbiosis of anaerobic fusospirochetes, *Streptococcus hemolyticus, Streptococcus viridans,* innumerable bacilli and other cocci complicate the bacteriologic picture of Vincent's infection. Although we have been commonly led to believe that these fusospirochetes are the cause of this condition, and we have good reasons to believe so, it has not yet been established as a scientific fact. Koch's postulate has not been satisfied, as we have been unable to produce a case of Vincent's infection experimentally in animals. The leading investigators agree that the streptococci activate the initial lesion and pave the way for the fusospirochetes as secondary invaders to act as harmful and dangerous saprophytes. When we consider the gangrenous nature of fusospirochetal disease in the mouth and other parts of the body and note the striking lesions, we cannot view the fusospirochetes in any other light.

ETIOLOGY AND PREDISPOSING CAUSES

In studying the etiology and predisposing causes of Vincent's infection, the

impression has unfortunately been overstressed that the disease is contracted from some one already infected. While this is obviously true, it has greatly tended to obscure many other important factors in the development of this disease.

We start with the known fact that this group of fusospirochetes are normally present in most mouths. With an environment favorable to their anaerobic cultivation, and a host with a lowered resistance, we have a most favorable background for the development of a case of Vincent's infection.

Primarily, the infection will be found in unclean, pyorrheic mouths. The

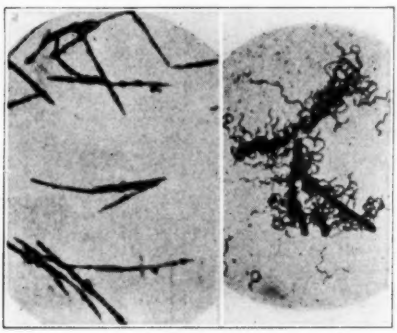


Fig. 3.—Left: Pure culture of fusiform bacilli taken from mouth clearly demonstrating metachromatic granules (carbol-fuchsin stain). Right: Pure culture of fusiform bacilli taken from tropical ulcer, showing distinctly flagella that partly resemble spirochetes (Zettnow's flagella stain). (After Kolle, Kraus and Uhlenhuth: Handb. d. path. Mikro-org., ed. 3, 1930, p. 812.)

pockets have been formed; the calculus and detritus are present, and the tone and resistance of the local tissues have been reduced. In addition to this local condition, there is usually a lowering of the systemic resistance, together with a faulty diet, to complete the picture. Therefore, it can readily be seen that it is not essential to contract the disease in order to become infected, and that the host may provide the hotbed for the cultivation in his own mouth by failure to observe those primary hygienic laws which good health and common sense dictate. One attack does not assure an immunity to subsequent attacks.

I have noted and classified certain regions in the mouth where conditions are favorable for the incubation of the fusospirochetes. These regions I have termed incubation zones, and I have classified them as follows, in the order of their importance:

Fig. 4.—Transverse section through part of tropical ulcer, showing spirochetes and fusiform bacilli between lymph spaces in epithelial cells (Levaditi staining method; ×1,000). This section shows how the spirochetes pave the way for the fusiform bacilli to follow the invasion of the normal tissue cells. (After Keysselitz and Meyer, in Kolle, Kraus and Uhlenhuth: Handb. d. path. Mikro-org., ed. 3, 1930, p. 812.)

INCUBATION ZONES

1. Pericoronal flaps on partly erupted mandibular third molars.

2. Buccal gingival margins of second and third molars in close contact with

the mucous membranes of the cheeks.

3. Deep periodontal pockets; palatal crevices of approximal gingivae in upper central incisors.

4. Areas of faulty restoration, overhanging crowns, overhanging fillings and unclean prostheses.

5. Tonsils.

6. Improper contact points on the interproximal surfaces, due to (a) malocclusion and (b) loss of contact due to failure to replace missing teeth, with consequent tipping of the approximating teeth and deep pocket formation.

7. Areas of irritation, arising from (*a*) traumagenic occlusion, (*b*) the presence of calculus, (*c*) the presence of detritus and filth pyorrhea and (*d*) smoking.

Fig. 5.—Pericoronal flap extending over right mandibular third molar, incubation zone being formed for development of Vincent's infection.

Fig. 6.—Appearance of mouth of girl, aged 21, with Vincent's infection. The patient had had no dental care for twelve years. There is necrotic tissue, with stub-shaped papillae, about the lower incisors. The infection was superimposed on a "filth" pyorrhea, which responded promptly to routine treatment.

It is because of the presence of these nests of incubation, which are essentially dental in character, and detection of which requires the keen eye of a dentist, trained to deal with these complex factors in the disease, that the treatment of Vincent's infection belongs to the dentist and not to the physician. Bloodgood reported that he never found the fusospirochetes in an edentulous mouth. It goes without saying that the physician should administer relief in such acute cases as come to his care until the patient can arrange for treatment with his dentist.

Having discussed the local factors, let us turn to the systemic and nutritional factors.

NUTRITIONAL FACTORS

The condition is probably due to (1) the absence or a deficiency of certain vitamins, especially vitamin C, as in scurvy; (2) malnutrition and deficiency in calcium and phosphorus, such as in faulty diet, and (3) disturbed metabolism.

SYSTEMIC OR DEBILITATING FACTORS

The following systemic conditions may be factors in Vincent's infection: scurvy, cancer, syphilis, alcoholism, diabetes, metallic poisoning, fatigue and dissipation, colds and the blood dyscrasias, such as leukemia, chronic anemia and granulocytopenia, or agranulocytosis.

LACK OF HYGIENE

Overcrowding or poor hygienic conditions, such as are found in jails, lumber or mining camps or military posts or under conditions of warfare may be factors in Vincent's infection. To sum up the causes of Vincent's infection, it may be stated that any condition which tends to decrease the vitality and thus lower the resistance and reduce the tone of the tissues may be a predisposing factor.

Although I have attempted to give weight to the many predisposing factors where conditions are favorable, we must not lose sight of the fact that it is a very communicable disease. Many cases that come to practitioners for treatment were

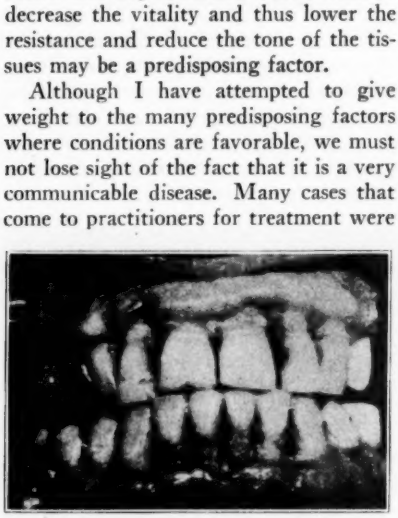


Fig. 7.—Typical case of acute Vincent's infection. "Filth" pyorrhea is present, with detritus and calculus deposits. There has been tremendous destruction of the bony structure and soft tissues. The gingiva has a deeply punched-out appearance interproximally. (After Sorrin, Sydney: D. Digest, 38:384 [Nov.] 1932.)

contracted in one way or another. Kissing and the use of common towels, drinking cups and glasses or other dishes, as at soda fountains and restaurants, lipsticks and pencils are the more common methods of contracting the disease from one already infected.

Although the disease occurs in both sexes and at all ages, from 2 to 12, and from 18 to 30 seem to be the most susceptible age periods.

This symbiosis of fusospirochetes almost always occurs between the gums and teeth in dirty mouths, in the presence of carious and pulpless teeth or inflamed gums. The dirtier the mouth, the more predominating the organisms and the more virulent they seem to be. These organisms are found in large numbers not only in acute, subacute and chronic stages of Vincent's infection but also in acute, and especially in chronic, cases of gingivitis.

In 1932, I made an investigation as to the incidence of the fusospirochetes in cases clinically free from Vincent's infection, and from an examination of

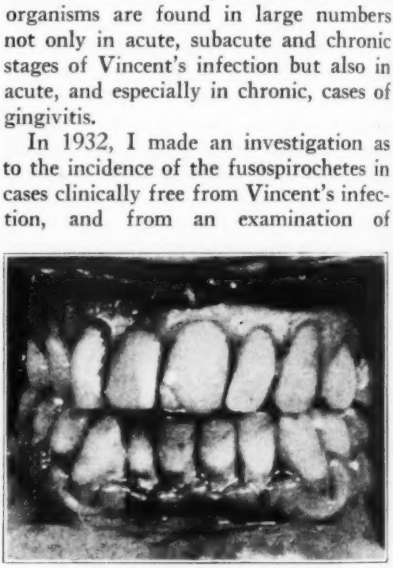


Fig. 8.—Subacute Vincent's infection recurring over a period of at least two years. The patient, a dentist, aged 32, resorted to the use of sample mouth washes for a cure. There are truncated cone-shaped papillae in the lower jaw and shortened labial segments of the papillae between the maxillary left incisors and cuspid, suggesting the presence of deep interproximal pockets. (After Hirschfeld, Isador: D. Items Int., 54:733 [Oct.] 1932.)

more than 400 cases at the Harvard Dental School and in private practice, I found, in many instances, a microscopic picture of Vincent's infection. It follows, then, that we cannot and should not rely on microscopic evidence alone for a diagnosis. Nevertheless, the microscope is to

the periodontist what the roentgenogram is to the oral surgeon.

In fusospirochetal infections, these organisms are found in large numbers in the zone between necrotic and living tissues. The spirochetes seem to favor the deeper tissues, where they are more abundant, and seem to advance into the normal tissues to prepare for the invasion of the fusiform bacilli. This may be clearly seen in histopathologic sections from fusospirochetal diseases.

In acute cases of Vincent's infection, smears from the gingival crevices and periodontal pockets always show a preponderance of fusospirochetes, which cover the entire microscopic field. Polymorphonuclear leukocytes are rarely seen in these smears because Vincent's is not a pus-producing disease. There are evident many types of bacilli, streptococci, staphylococci, spirilla and vibriones.

Vincent's angina is most commonly confused with Vincent's infection. The former is a disease of the throat, affecting the pharynx and tonsillar regions, from where it can readily spread to the bronchi and lungs. It is often fatal. There are three important facts for the dentist to bear in mind as he studies the pathology of Vincent's angina: 1. It is believed that disease commonly results from aspiration of the fusospirochetal organisms from the gingival tissues. There is great danger, therefore, in administering any general anesthetic in an acute Vincent's angina, and as great danger in spraying medicaments under air pressure. 2. The microscopic picture in Vincent's angina is the same as in Vincent's infection. 3. Bronchial and lung infection by the fusospirochetes may arise from either infection.

From a survey of all the fusospirochetal infections in the various parts of the body, the striking fact stands out that the microscopic picture in these various manifestations bears strong similarity to the microscopic picture in Vincent's infection and Vincent's angina. All of these diseases are preventable, and most of them can be traced to the oral cavity. If we can practice preventive dentistry by maintaining the mouths of our patients in a physiologic condition, we shall be the greatest force in the en-

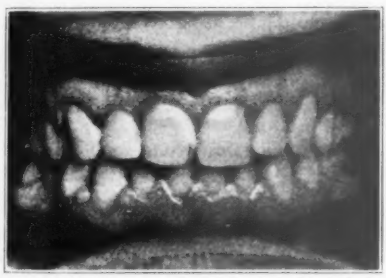


Fig. 9.—Recurrent subacute hypertrophic Vincent's infection. There are highly inflamed points of the septal gingiva on either side of the maxillary right cuspid. Those between the mandibular incisors have an edematous appearance. As a result, the marginal gingivae form a zigzag line. (After Hirschfeld, Isador: D. Items Int., 54:736 [Oct.] 1932.)

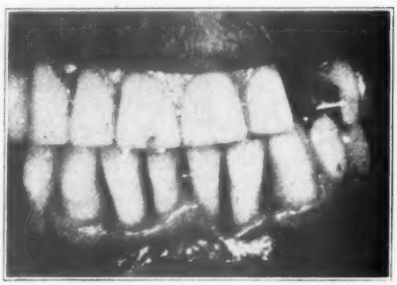


Fig. 10.—Chronic Vincent's infection, showing loss of tissue on lower teeth. The gingivae have the typical punched-out appearance interproximally. (After Sorrin, Sydney: D. Digest, 38:383 [Nov.] 1932.)

tire realm of medicine in stamping out fusospirochetal diseases.

CLINICAL PICTURE

In general, there are three types of Vincent's infection: acute, subacute and chronic. The clinical picture of this disease has been described with many variations by numerous authorities.

There may be present in an acute case, all or some of the following symptoms, especially if the disease has been contracted from another: (1) sudden onset; (2) malaise and lassitude; (3) general weakening of the body, with loss of appetite; (4) an intestinal disturbance varying from indigestion to diarrhea, and perhaps vomiting; (5) an abnormal temperature accompanied by a feverish feeling, and acceleration of the pulse, and (6) headache, restlessness, insomnia and physical fatigue.

The local symptoms are as follows:

1. The gingival tissues are red, swollen and painful.
2. There is a grayish white slough on the surface of the gums.
3. The gingivae are extremely tender to the touch.
4. The surfaces of the gingivae appear raw and bleed readily.
5. Sloughing may spread to the cheeks and soft palate, but rarely to the tongue.
6. There is almost always present either a punched-out appearance of the interproximal gingival margins or an edematous hypertrophic congestion of the gingiva.
7. There is a metallic taste in the mouth, with a marked increase of viscid salivation.
8. There is a putrid odor from the mouth.
9. The pharynx is red and inflamed and there is difficulty in swallowing.
10. Lesions may be present on the lips or corners of the mouth, of a herpetic nature, suggestive of syphilis.
11. The teeth all seem to ache, and may seem loose or have a "wooden" feeling.
12. The submaxillary glands are often involved, being tender and swollen.

The bleeding is due to the destruction of the normal squamous epithelial cells, exposing the minute capillaries and blood vessels, and leaving a raw bleeding surface. The process is of a destructive, gangrenous nature. The ulceration is rapidly progressive and the tissues often break down overnight. Later in the progress of the disease, deep ulceration beneath the pseudomembrane takes place, producing the typical punched-out appearance of the interproximal gingival margins.

In an effort to recognize and to diagnose every case of Vincent's infection that comes to our attention, we may sometimes look for typical symptoms in every case. While we should constantly bear in mind the various pathologic manifestations that may resemble the condition or be mistaken for it, a word of caution with regard to looking for a "typical" picture in every instance will not be amiss. The numerous symptoms and the degree of virulence of the bacteria, together with the degree of lowered resistance of the host, allow for a wide variety of pictures in cases of Vincent's infection. In some instances, marked systemic symptoms may be relatively few and mild, or may be entirely absent.

It hardly seems possible for a patient to have an acute Vincent's infection without being aware of it, for mastication of food, and especially hard substances such as bread crust, would provoke pain in the gums, which is not a natural phenomenon in health or even in pyorrhea.

While all these symptoms are associated with acute Vincent's infection, it is not probable that all of them will be present in any one case, and quite possible that some or many of them will be lacking in certain cases.

TREATMENT

If the numerous synonyms for Vincent's infection and the fusospirochetal organisms have caused confusion in our minds, we experience greater confusion when we approach the treatment of this disease, as we are confronted with the widest and most conflicting array of drugs in the realm of medical science. I have classified over sixty-five conflicting treatments and have reduced to four the generally accepted means of treatment: (1) the arsenical group of drugs, (2) Churchill's iodine-silver nitrate medicament, (3) metaphen and the aniline dyes and (4) chromic acid.

Chromic Acid Treatment.—The use of chromic acid is probably the most nearly universal treatment for Vincent's infection. Although the use of this drug has been subjected to much criticism, if it is properly used its harmful effects will be obviated and excellent results obtained.

The reason this drug and other effective drugs have proved ineffectual in the treatment of this disease is that we have been mopping over the surfaces of the oral tissues, failing to get the drug into the gingival crevices, the periodontal pockets and the incubation zones. The fault lies not with the drug, but, as usual, with the operator. In those cases that remain uncured, the acute stages of the disease have been relieved, but the incubation zones have not been completely eradicated. As a result, after a year or more, the patient is suffering from chronic Vincent's infection.

Treatment of Acute Stage.—Chromic acid is employed in various strengths. In my hands, an 8-10 per cent solution has proved effective. The area to be treated is isolated with cotton rolls or small dental napkins, and the saliva ejector is inserted. Absorbent cotton pledgets are counted out and placed on a paper napkin on the tray. Each pledget is dipped in the chromic acid solution, inserted in the interproximal crevice and gently teased down into the depth of the pocket and under the buccal gingival crevice by the use of cotton pliers or a scaler. This is repeated in each interproximal space in the area under treatment. If one quarter of the mouth is being treated at a time, I start with the last molar and go forward to the central incisors. By the time the last pledget is inserted in the central interproximal space, I begin to remove the pledgets from the molar area, coming forward until the last pledget is removed from the central area. I follow this procedure immediately with a pellet saturated with hydrogen peroxide and touch up the places where the chromic acid was applied. This forms a bluish black liquid of chromium trioxide, liberating further oxygen and neutralizing the chromic acid remaining on the enamel surfaces, thereby avoiding etching and discoloration of the enamel.

I follow the same procedure around all the teeth, making certain to get the chromic acid under the gingival crevices and into the depths of all the pockets. The cotton pledgets are counted before and after treatment, exactly as a surgeon takes a sponge count, to make certain that no pledgets are left in the gingival pockets.

After each section of the mouth is treated, the mouth is washed with a warm solution of sodium perborate, one teaspoonful to three-fourths glass of warm water. The ulcerous patches on

the mucous membranes and soft palate are also treated with a topical application of chromic acid and the surface necrotic tissue is gently wiped away. This constitutes the first treatment. Treatment is repeated daily for two or three days, at which time there is a remarkable improvement in the patient. There is a shedding of the necrotic membrane, which is usually replaced by a healthy pink layer of epithelium. The swelling and engorgement of the gingival tissues has been greatly reduced, the pain diminished and the hemorrhage stopped.

Certain practitioners carry their cases through to completion with the use of chromic acid. I have found that this is effective in the acute stages, but when the acute gingivitis has subsided, the use of milder drugs is more effective in completing the treatment. With this knowledge, as soon as the acute condition has subsided, I substitute the use of either 1 per cent acriviolet or tincture of metaphen, which are mild, nontoxic and noncaustic, and are 100 per cent effective not only in their spirocheticidal action, but also in their effect on gram-positive as well as gram-negative organisms. By the time the use of metaphen or acriviolet is begun, the mouth will be in a condition of comfort, and it will be possible to take roentgenograms of the teeth and impressions for study models.

From this point, the case is treated as any case of periodontoclasia. The patient is seen twice a week, when scaling and apoxesis is performed. The scaling of the root surfaces should be cautiously undertaken after the acute stage has subsided. The instruments should be dipped in either metaphen or acriviolet during apoxesis as a precaution against infection. The proper steps are now taken to eliminate the zones of incubation that I have previously classified. No case can be considered cured until the causes have been corrected.

For home treatment, I prescribe a solution of warm sodium perborate, one teaspoonful to three quarters of a glass of warm water every two hours, alternating with hexylresorcinol full strength to combat the streptococcus invasion that accompanies this infection. After two or three days, hexylresorcinol is discontinued and hydrogen peroxide substituted therefor. After office treatment is completed, the use of a sodium perborate mouth wash three or four times daily for about a month is advised as a safety factor. At this stage, sodium perborate should be discontinued as it is entirely unsuitable for daily use in the absence of Vincent's infection.

For home treatment, I prescribe a cathartic, at least 2 full glasses of orange juice daily, a quart of milk daily and plenty of raw fruits and vegetables, especially lettuce, tomatoes and raw cabbage. For nourishment, I advise mostly liquids, such as beef broth, chicken broth, ovaltine, ice cream, etc. The use of alcohol and tobacco is prohibited, and the patient is cautioned against using spicy foods. The seriousness of the disease, the danger of spreading it and the importance of absolute cooperation are emphasized. I advise the use of paper cups and paper plates at home when possible, or else the use of a separate set of dishes, which are boiled after use.

CONCLUSIONS

From a comprehensive study of fusospirochetal diseases, with particular reference to Vincent's infection, the following conclusions may be reached:

1. Vincent's, as well as other forms of fusospirochetal diseases, is preventable.
2. The diagnosis of acute Vincent's infection can be readily established.
3. Our present knowledge indicates

that the oral fusospirochetes are important and dangerous saprophytes in a symbiosis of anaerobic organisms, capable of initiating a severe and often fatal disease.

4. Because of its complex oral predisposing causes and effects, the treatment of Vincent's infection belongs to the dentist and not to the physician. The physician should be consulted.

5. Chromic acid, properly applied, is one of the most nearly universal medicaments employed today.

6. We should depend on skilful application of professional knowledge and experience rather than on drugs alone for cure.

7. We should not depend on a microscopic examination alone for a diagnosis.

8. No case can be considered cured until all the predisposing causes have been eliminated.

LACTOBACILLUS ACIDOPHILUS IN DENTAL CARIES*

By MARION M. JOHNSTON, C. H. M. WILLIAMS, P. G. ANDERSON, T. G. H. DRAKE, F. F. TISDALL and MILDRED J. KAAKE, Toronto, Canada

IN recent years, Bunting and his coworkers at the University of Michigan[1] have concluded that a representative of the Lactobacillus genus, held by them to be *L. acidophilus,* is the specific etiologic factor in dental caries. They have asserted that in active caries, as a rule, there is a luxuriant growth of this micro-organism, it being constantly found on the teeth and in the saliva; while, in the absence of active lesions, it is either totally absent or is present in relatively small numbers. In order to test the validity of these conclusions, the work here reported was initiated. Bacteriologic cultures of the mouth were taken from a selected group of thirty-nine children over a period of one year, during which period careful dental examinations were conducted.

BACTERIOLOGIC METHODS

The difficulties encountered in the use of the Rodriguez[2] carbon dioxide-serum-agar method of cultivating *Lactobacillus acidophilus* and the apparently satisfactory results achieved by the tomato-agar medium method described by Hadley[3] led us to adopt the Hadley method in its entirety. Saliva was collected by the chewing of paraffin, all the saliva being expectorated into sterile corked tubes, which were transported to the laboratory as rapidly as possible, the material being immediately spread upon tomato-agar plates. A preliminary examination indicated which children had a saliva of high acidophilus content, which necessitated suitable dilution prior to plating in order to render possible a numerical estimation of the bacilli present. After thorough shaking, 0.1 and 0.4 c.c. of the saliva that did not require dilution was spread directly on each of the two plates. As sug-

*From the Department of Pediatrics, University of Toronto, and the Hospital for Sick Children.

1. Bunting, R. W.: Science, 78:419, 1933.

2. Rodriguez, F. E.: Method of Determining Quantitatively Incidence of Lactobacillus Acidophilus-Odontolyticus in Oral Cavity, J.A.D.A., 17:1711 (Sept.) 1930.

3. Hadley, F. P.: J. D. Res., 13:415 (Oct.) 1933.

gested in Hadley's report, 1:50 and 1:200 dilutions of the saliva requiring dilution were made in a sterile buffered physiologic sodium chloride solution with phosphates to p_H 7. One-tenth cubic centimeter of each dilution was spread on each of two tomato-agar plates. The qualitative test consisted of the planting of 0.4 c.c. saliva (the larger amount plated directly) in sterile glucose meat infusion broth p_H 5. Incubation at 37 C. of plates (quantitative test) and tubes (qualitative test) was carried on for about seventy-two hours. Thereafter, the various types of colonies that grew on the plates were noted; smears were made and stained by Gram's method, and colonies that appeared in smears to probably be *Lactobacillus acidophilus* were counted. Various types of colonies of this bacterial species were noted. White shiny convex colonies consisted of somewhat coherent bacilli that were either the horseshoe-shaped Type I (Hadley) forms or the ordinary parallel rods of Type II. Small flat fine gray colonies comprised the more pleomorphic Type III (Hadley) bacilli. In qualitative tests centrifuged, bacteriologic loopfuls of the sediment were transferred to glass slides and stained by Gram's method. These smears showed gram-positive nonsporulating bacilli that had grown aerobically on an acid medium. They also grew in broth in somewhat anaerobic conditions. They were acidophilic and, by growth in the broth, were also shown to be aciduric. Smears prepared from colonies growing on a solid medium showed parallel rods in pairs or triads. Smears from broth showed parallel pairs or chains of slender rods. These bacilli did not grow on plain agar.

The results here reported were based for the most part on the data accruing from the quantitative estimations, although usually both methods of determination carried out simultaneously on the same sample gave positive results. Sometimes, the qualitative test only was used when the quantitative was negative.

Table 1.—Relation of Lactobacillus Acidophilus to Dental Caries

Caries	Bacteriologic Examination			
	L. Acidophilus Continuously Present	L. Acidophilus Continuously Absent	L. Acidophilus Sporadically Present	Total Number of Cases
Markedly progressive	1	0	0	1
Slightly progressive	4	0	1	5
Very slightly progressive	0	2	1	3
Nonprogressive	1	18	8	27
Doubtful	0	2	1	3
Total number of cases	6	22	11	39

DENTAL AND BACTERIOLOGIC EXAMINATIONS

In May, 1934, very careful clinical and roentgenologic dental examinations were made. Bitewing roentgenograms were made of all the teeth of every child. The hard tissue examination was made

with meticulous care.[4] Our initial examinations having been completed, a group from Dr. Bunting's clinic, consisting of Philip Jay and Dorothy G. Hard and Mrs. Faith P. Hadley, visited our institution and carried out an independent bacteriologic and clinical dental examination on the same group of children. In the case of every child, these independently conducted bacteriologic examinations gave results identical with ours. From May, 1934, to May, 1935, we made monthly bacteriologic counts. Clinical and roentgenologic dental examinations were made at the conclusion of this one-year period. After our final examination had been completed, the Michigan group of investigators, consisting of Drs. Bunting, Jay and Hard, again visited us and repeated the clinical dental examinations. After this final dental examination, the degree of progress of the carious process from May, 1934, to May, 1935, was determined, being found identical by the two groups of investigators, each of which had made an independent examination of the teeth at the beginning and end of the period.

RESULTS

In Table 1 is shown the correlation of the bacteriologic and dental findings. There was very little progress in the carious conditions in the group. Of the thirty-nine children, nine showed progressive caries. In only one of these was the process marked. Twenty-seven manifested no change, and in three the change was doubtful.

Considering the group of nine children who gave evidence of progressive caries, the presence of *Lactobacillus acidophilus* was continuously demonstrated in the mouths of five of these, or 55 per cent.

In the group of twenty-seven children in which there was no evidence of progressive caries, *Lactobacillus acidophilus* was never found in the mouths of eighteen of these, or 66 per cent.

Lactobacillus acidophilus was continuously found in 55 per cent of the children of the first group, and was continuously absent in the mouths of 66 per cent of the second group. It is probable that the first group is too small to give due mathematical significance to the findings. On the other hand, it is to be noted that while *Lactobacillus acidophilus* was continuously present in approximately 55 per cent of the children showing progressive caries, it was only continuously present in about 4 per cent of the children who gave no evidence of progressive caries.

Table 2.—Relation of Gram-Positive Cocci Isolated from Saliva to Progressive Caries

Caries	Gram-Positive Cocci			
	Continuously Present	Continuously Absent	Sporadically Present	Total Number of Cases
Progressive	2	0	7	9
Nonprogressive	11	2	14	27
Doubtful	0	0	3	3
Total number of cases	13	2	24	39

4. Anderson, P. G., et al.: Influence of Vitamin D on Prevention of Dental Caries, J.A.D.A., 21:1349 (Jan.) 1934.

In regard to those children in whom the bacteriologic examination demonstrated *Lactobacillus acidophilus* to be only sporadically present, Table 1 shows that two manifested progressive caries, and eight nonprogressive caries; while in one, the degree of carious progression could not be properly adjudicated. Of the two showing progressive caries, one has shown *Lactobacillus acidophilus* in the last three counts, from March, 1935, to May, 1935. The development of this carious condition might have resulted from the presence of these organisms during these three months. The other case with progressive caries showed *Lactobacillus acidophilus* in the early examinations, followed by a series of negatives, then one or two positives, and the most recent entirely negative. Of the eight nonprogressive cases in which the appearance of *Lactobacillus acidophilus* was noted, seven showed it very infrequently. In one of the seven, the first count was positive, then negative for all others up to the last one, which has become positive. One other had a negative count, then a positive followed by a negative period. In four, the first counts were positive, followed by a negative series, then positive again, and the last counts were negative. The seventh had two negative counts, followed by two doubtful ones, then six alternately negative and positive, and the final one was positive.

In some cases, we also made quantitative estimations of the more common micro-organisms that have appeared on the quantitative plates in addition to *Lactobacillus acidophilus*. Yeasts, gram-positive cocci, *M. tetragenus*, staphylococci and streptococci were frequently found. We noted that the flora have been very meager on the plates of many children whose *Lactobacillus acidophilus* counts have been continuously low or negative, as if some inhibitory influence diminished all bacterial growth. In contrast, in some instances, when the *Lactobacillus acidophilus* counts have been low, the other forms were high. In other cases, where the *Lactobacillus acidophilus* count was high, counts of these other forms were also continuously high. In certain children who had high *Lactobacillus acidophilus* counts continuously, these other forms were continuously low. In Table 2, based on the quantitative tests only, is shown the relationship of the carious condition to a species of gram-positive coccus that appears to be very commonly found in the saliva. It is aerobic and acidophilic and produces acid. All qualitative tests revealed its presence as long chains of ellipsoid cocci. If this species were to be considered of etiologic importance, it should be present in the cases showing progressive caries. Only two of the nine cases, or about 22 per cent, showed the species quantitatively. Again, it should be lacking in the nonprogressive cases, and was found to be present constantly in eleven of the twenty-seven nonprogressive cases, that is, in about 41 per cent, and present sporadically in fourteen of the twenty-seven cases, or 52 per cent. In other words, it was cultured in twenty-five of the twenty-seven nonprogressive caries cases either constantly or sporadically. These findings illustrate the data which were compiled with respect to the yeasts and other forms the presence of which was estimated numerically. No constant relationship between any one of these species of micro-organisms and the progression of caries in these cases could be elicited.

An attempt to demonstrate an inhibitory substance for *Lactobacillus acidophilus* in the saliva of persons who had no *Lactobacillus acidophilus* and a low incidence of other forms failed.

No agglutinins or precipitins were found in any saliva examined.

In the cases in which *Lactobacillus acidophilus* was found only sporadically, some doubt might exist that the species being isolated in such cases was really *L. acidophilus*. One strain from a sporadic case was selected. With a suspension of it as antigen, an agglutinating serum was prepared. It was found that most of our strains, whether from continuously positive or sporadic cases, were agglutinated by this serum. One other means of establishing the uniformity of the strains isolated would consist in the isolation of the specific carbohydrate of the species and precipitin tests with immune serum. This substance might be useful for demonstration of immune bodies in saliva, since, so far, the demonstration of such bodies has been unsatisfactory.

SUMMARY

In a one-year study of dental caries, only nine children in a group of thirty-nine living in an institution under excellent circumstances were found to have progressive caries. In eight of these cases, the carious process was slight, and in only one was the process marked.

Among the group exhibiting progressive caries, *Lactobacillus acidophilus* was continuously absent in two. It should be noted that, in both instances, the degree of progression of the carious process was extremely slight.

Among the group exhibiting progressive caries, *Lactobacillus acidophilus* was present continuously in five of nine cases, approximately 55 per cent; while in the twenty-seven cases with nonprogressive caries, *Lactobacillus acidophilus* was present continuously in only one, or approximately 4 per cent.

Among the group with no progressive caries, *Lactobacillus acidophilus* was continuously absent in eighteen out of twenty-seven cases, or 66 per cent.

Among the group with no progressive caries, *Lactobacillus acidophilus* was sporadically present in eight cases, and in seven of these, this organism was noted very infrequently.

Lactobacillus acidophilus, whether isolated from positive or sporadic cases, was found to be the same bacterial species.

No agglutinins or precipitins or inhibitory bodies for *Lactobacillus acidophilus* were found in saliva from negative cases.

Micro-organisms other than *Lactobacillus acidophilus* were present in saliva and produced acid when grown in certain mediums. The degree of acidity produced by these organisms was comparable to that produced by *Lactobacillus acidolphilus* growing in similar mediums. These micro-organisms had a low incidence in many cases wherein *Lactobacillus acidophilus* was either absent or present in very low numbers. It was also true that they were entirely wanting in some cases in which *Lactobacillus acidophilus* was present in large numbers. Conversely, these other micro-organisms were sometimes present in large numbers with or without *Lactobacillus acidophilus*. Progressive caries did not seem to be related to any one of these other species.

A PROGRESS REPORT ON DENTURE BASE MATERIAL (1935)*

By W. T. SWEENEY,† A.B., and IRL C. SCHOONOVER‡, Ph.D., Washington, D. C.

THE dental research that has been in progress at the National Bureau of Standards for the last sixteen years has dealt principally with materials used in operative dentistry. This research was extended to prosthetic materials when the Bureau approved a request by the House of Delegates of the American Dental Association at the 1933 Chicago meeting. The Research Commission was asked to include a study of denture materials in its program at the National Bureau of Standards as soon as practicable.

A preliminary survey was made at this Bureau by Dr. Barber,[1] of the Navy Dental Corps, in 1934. The present investigation is an extension of this survey.

The need for the dentist to have some method other than clinical for judging the relative merits of different materials is apparent to any one who reviews the literature and who is familiar with the experience of the profession. Failure of so many of the materials sold to the profession during the last few years to live up to glowing advertising claims has meant bitter disappointment. During the last ten years, more than thirty different trade brands of materials, other than rubber, have been offered for sale to the dentist. The scheme of having the dentist test all of these materials clinically has been unfair to both dentist and patient and has been very expensive.

This research was started with the object of developing a set of tests, and test methods, which will satisfactorily establish the suitability of a denture-base material. It was soon found that progress would be slow and that the answers to the problems confronting the dentist relative to the use of denture materials would be found only after extensive tests and test procedures were standardized.

The lack of information as to what physical properties are essential for satisfactory dentures has materially retarded the investigation.

This progress report gives some of the physical and chemical properties of representative types of denture bases studied. The difficulties in defining a group of materials that, in general, occupy a position somewhere between the elastic solids and viscous liquids are numerous, chiefly because testing procedures are not available to define these materials accurately. Thus, it seems necessary to know how to classify each material before a set of tests can be used

*A report to the Research Commission of the American Dental Association.

*Publication authorized by the Executive Board of the Research Commission.

†Research Associate of the American Dental Association at the National Bureau of Standards.

‡Assistant Chemist, National Bureau of Standards.

1. Barber, Ronald: Preliminary Tests of Some of the Newer Denture Materials, J.A. D.A., 21:1969 (Nov.) 1934.

to satisfactorily describe its action under oral conditions.

Materials that have been relatively satisfactory for a long period of time, such as the rubber bases, may be used as a preliminary criterion in such an investigation. Test methods that will define the properties of rubber and compare them with other materials are being gradually developed. Of course, certain properties of rubbers are not desirable, and, in the appraisal of the suitability of other materials, these features must be considered.

The program is planned to continue until enough information is available to specify what properties are necessary and how to measure these properties. The dentist can then use the specification as a standard of quality for any denture base material that he wishes to employ.

MATERIALS STUDIED

The materials studied and reported on were obtained through the regular dental trade channels. They are here divided into four groups: (1) rubber, (2) vinyl resin, (3) phenol-formaldehyde resin and (4) cellulose nitrate compounds. Different types of rubber, such as olive, metal-filled, maroon, pink base types and a pink veneer, were included. One typical trade brand product in each of the three other groups was studied. These four types included two thermoplastic materials (vinyl and cellulose) and two thermosetting materials (rubber and phenol-formaldehyde). It was thought that if satisfactory test methods could be developed for these types of materials, a satisfactory basis could be had for evaluating any resinous denture-base material that might give promise of

TABLE 1.—PREPARATION OF SAMPLES

Sample	Material	Remarks
A	Olive base rubber	Heated to 320 F. (160 C.) in one hour and held for two hours at that temperature.
B	Olive base rubber	Heated to 300 F. (149 C.) in thirty minutes and held for one hour at that point.
C	Metal filled base rubber	Heated to 320 F. (160 C.) in one hour and held for two hours at that point.
D	Maroon rubber	Heated to 300 F. (149 C.) in one and one-half hours and held one hour at that point.
E	Pink veneer rubber	Heated to 320 F. (160 C.) in one hour and held two and one-half hours at that point.
F	Pink rubber	Heated to 300 F. (149 C.) in thirty minutes and held one hour at that point.
G	Vinyl resin	Pressed at 275 F. (135 C.)
H	Phenol-formaldehyde resin	Heated for fifteen minutes to 212 F. (100 C.), and for twenty minutes to 266 F. (130 C.) and held at that point for two and one-half hours.
I	Cellulose nitrate compound	Pressed at 236 F. (113 C.) to 245 F. (118 C.)

merit sufficient to justify its serious consideration.

PREPARATION OF SPECIMENS

In preparing specimens for most of the tests, the materials were molded or cured in the form of sheets or plates approximately 250 mm. long, 125 mm. wide and 4 mm. thick, from which specimens were cut. The processing time and temperature used in the preparation of the specimens are given in Table 1. They are identical, in most cases, with the manufacturer's recommendations. Some specimens were prepared in metal molds; others, in plaster molds. No significant differences were noted between metal molded specimens and those prepared by using the usual dental laboratory vulcanizing plasters.

Simple symmetrical specimens were used, because it would be impossible to analyze and interpret any test involving the use of an unsymmetrical or odd-shaped specimen, which would be subjected to a variety of forces such as shearing, tensile, torsion and compression. This is illustrated very strikingly in the

TABLE 2.—TENSILE PROPERTIES OF DENTURE MATERIALS

Sample	Material	Proportional Limit		Ultimate Tensile Strength		Set (50 Mm. Gage)
		Kg./Cm.²	Lb./In.²	Kg./Cm.²	Lb./In.²	Per Cent
A	Olive base rubber	260	3700	555	7900	1.7
B	Olive base rubber	246	3500	534	7600	2.0
C	Metal filled base rubber	281	4000	534	7600	1.3
D	Maroon rubber	295	4200	570	8100	0.7
E	Pink veneer rubber	225	3200	450	6400	0.5
G	Vinyl resin	288	4100	577	8200	3.5
H	Phenol-formaldehyde resin	*	*	443	6300	0.2
I	Cellulose nitrate compound	176	2500	380	5400	26.5

*Approaches value for ultimate tensile strength.

TABLE 3.—IMPACT TESTS ON DENTURE MATERIALS

Sample	Material	Impact Strength		
		Range		Average
		From Cm.-Kg. per Cm.²	To Cm.-Kg. per Cm.²	Cm.-Kg. per Cm.²
A	Olive base rubber	11	18	14
B	Olive base rubber	28	43	38
C	Metal filled base rubber	30	53	46
D	Maroon rubber	4	7	5
F	Pink base rubber	2	6	3
G	Vinyl resin*	106	109	107
H	Phenol-formaldehyde resin	2	6	3
I	Cellulose compound*	67	96	87

*All the specimens did not fracture completely.

case of a denture when the application of a load on one area, for example the molar region, produces stress or strain in all other parts of the irregularly shaped denture.

In the preparation of the specimens, the outside layer of the original plate was removed to simulate more nearly the finished surface condition of a denture, but no evidence was obtained as to whether the original material had a skin of different properties from the interior or whether the material was homogeneous.

in this paper. Figure 2 shows typical curves.

It may be seen from Figure 2 that these curves all have about the same general shape, with the exception of the curve for the cellulose nitrate compound I, which shows a greater deformation for a given load than do the other materials. The curves are concave toward the strain axis; which indicates that the higher the load, the greater the deformation produced by a given increment of load.

Proportional limit for these materials

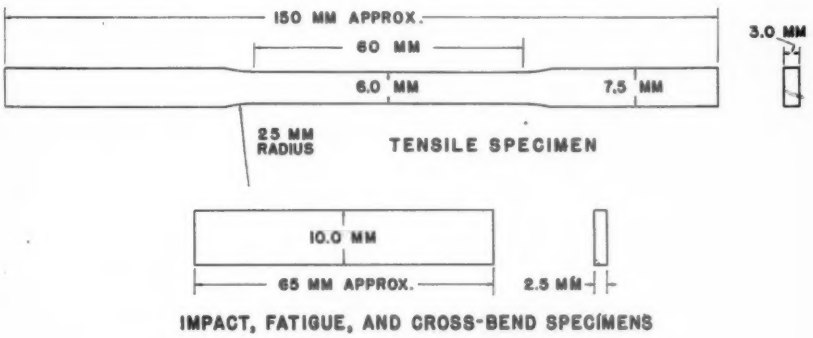


Fig. 1.—Standard sizes of test specimens.

PHYSICAL PROPERTIES

1. *Tensile Properties.*[3]—The tests were made in a 600-pound (270 kg.) capacity Amsler hand-driven testing machine. Specimens were milled from plates to the dimensions shown in Figure 1. The load was applied at approximately 10 pounds (4.5 kg.) per minute at room temperature. The strain was measured with an averaging extensometer on a 50 mm. gage length. Observations were taken to determine the stress-strain curve over the lower range. In most cases, the observations extended above the proportional limit as defined is designated as the point where a given increment of stress produces one and one fourth times the elongation that was produced by the same increment of stress at lower stresses. The true proportional limit for these materials cannot be obtained, as in metals, even at very low stresses, since here the strain is only approximately proportional to the stress. (Fig. 2.) The proportional limit as shown in this paper probably has little real significance in its dental application.

Tensile strength is the load per unit area necessary to rupture the specimen, computed on the original cross-sectional

area of the specimen rather than the area at the instant of breaking. Tensile strength is one of the important properties of materials used in engineering and is useful for comparing different materials.

The tensile strength values for the different materials are shown in Table 2. The material may be divided into three groups on the basis of tensile strength, the highest group including vinyl resin and the rubber compounds, except the pink veneer rubber; an intermediate group including the pink veneer rubber and the phenol-formaldehyde resin, and the lowest group including the cellulose nitrate compound.

Set: A 50 mm. gage length was marked off on the tensile specimen before applying the stress. After rupture, the pieces were assembled and the increase in distance between the gage marks were measured, and expressed in percentage. The set or plastic elongation represents the flow that occurs when a specimen is stressed to failure and is only a part of the total elongation. In the case of rubber, the elongation at break may be as much as from 5 to 8 per cent; whereas the set, as shown

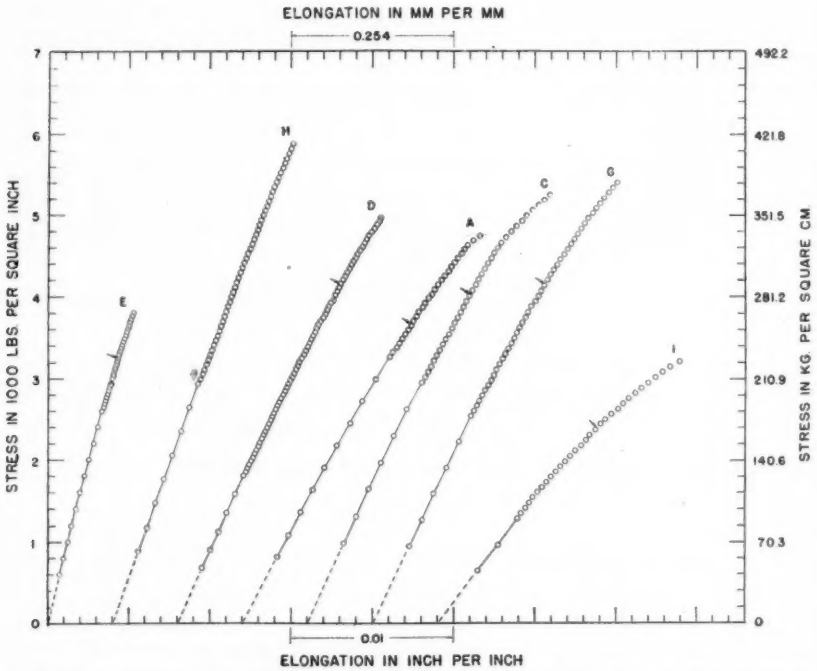


Fig. 2.—Representative stress-strain curves of seven denture materials. *E*, pink veneer rubber; *H*, phenol-formaldehyde resin; *D*, maroon rubber; *A*, olive base rubber; *C*, metal-filled base rubber; *G*, vinyl resin; *I*, cellulose nitrate compound. The arrow indicates the proportional limit.

in Table 2, ranges from 0.5 to 2.0 per cent. This may explain why such a material is not brittle and seldom fails in service, since it is able to absorb shocks. of the hammer blow. The energy absorbed by the specimen is recorded in Table 3 as the impact strength. It should be remembered that impact tests

TABLE 4.—THERMAL CONDUCTIVITY*

Sample	Material	Milliwatts per Sq. Cm. per Degrees C. per Cm.
A	Olive base rubber	1.6
C	Metal filled base rubber	1.5_5
D	Maroon rubber	1.7
G	Vinyl resin	1.5_5
H	Phenol-formaldehyde resin	2.3
I	Cellulose nitrate compound	2.0
	Gold	2940.0
	Platinum	696.0
	Gold alloy (10 per cent platinum)	690.0
	Gold alloy (12 per cent copper)	600.0
	Stainless steel (18 Cr, 8 Ni)†	145.0
	Glass (window)	10.5
	Cement (zinc phosphate)‡	4.8
	Hard rubber	1.6
	Cork board	0.4

*Other values were taken from Int. Critical Tables.
†Shelton, S. M.: Bur. Stan. J. Res., 12:441, 1934.
‡Gillett and Irving: Gold Inlays by Indirect System, Brooklyn: Dental Items of Interest Publishing Co.

TABLE 5.—CHEMICAL ANALYSIS OF UNVULCANIZED DENTAL RUBBERS*

Sample	Material	Acetone Extract†	Free Sulphur	Total Nonvolatile Residue
		Per Cent	Per Cent	Per Cent
A	Olive base rubber	2.4	28.7	8.5
C	Metal filled base rubber	4.0	24.3	6.4
D	Maroon rubber	4.9	21.4	3.7
E	Pink veneer rubber	1.4	6.6	35.9
F	Pink rubber	2.2	11.9	2.2

*Analysis by method outlined in U. S. Federal Specification ZZR601, February 1930.
†Corrected for free sulphur.

2. *Impact Strength.*—Impact test: Impact tests were made on a Schopper (Charpy type) impact machine.[1] The specimens (Fig. 1) were broken by placing the small dimension in the direction are comparable only when made under strictly similar conditions; but, when so carried out, they do give a very convenient method of comparing materials of the same class. It is important that

denture materials have a satisfactory resistance to breakage from dropping and sudden shocks. Other things being equal, the material having highest impact strength should be the least liable to fracture when dropped or given rough treatment outside the mouth.

An examination of Table 3 shows that dental rubber has a very wide range of impact strengths, depending on the amount of rubber hydrocarbon present. Rubber containing a high percentage of

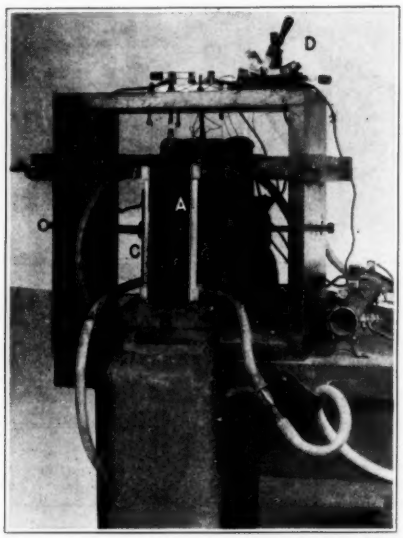


Fig. 3.—Apparatus for determining thermal conductivity. *A*, specimen; *B*, hot plate; *C*, cold plate; *D*, thermocouple outlets from different sections of specimens.

fillers shows lower impact strength than the base type. Therefore, the veneer rubbers with a large percentage of filler are more liable to fracture from sudden blows than are the base type. Phenol-formaldehyde resin H had a low impact strength. It is comparable to the pink rubbers in this respect. The vinyl resin G and the cellulose nitrate compound I have high impact strength, and should be reasonably free from breakage caused by dropping or other types of impact.

3. *Flexural Fatigue Tests.*—The machines used for these tests were described in the preliminary report.[1] The specimens (Fig. 1) were approximately 10 mm. wide, 2.5 mm. thick and 65 mm.

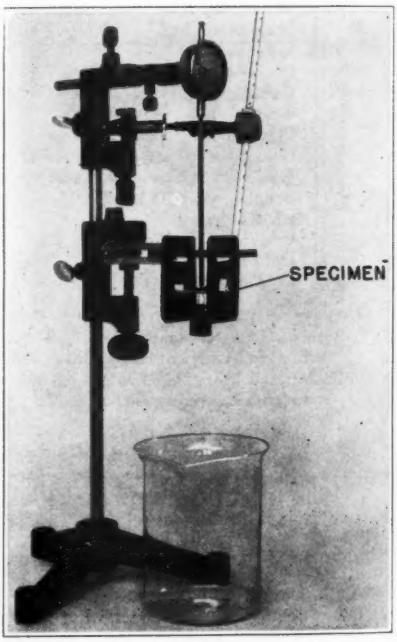


Fig. 4.—Apparatus used for measuring bending of denture materials while being heated.

long, and were cut from regularly prepared sheets of the material. Thinner specimens were used, more nearly comparable in thickness to a denture than those that were employed in the previous investigation. For this reason, lighter dynamometer springs were built so as to

TABLE 6.—SORPTION OF WATER BY DENTURE MATERIALS AT ROOM TEMPERATURE

Sample	Material	Vulcanized at 160 C. (320 F.)	Density	Free Sulphur	Increase in Weight per Square Centimeter of Surface Area					
					1 Week	2 Weeks	3 Weeks	7 Weeks	22 Weeks	27 Weeks
Column	1	2	3	4	5	6	7	8	9	10
		Hours	G/Cm.³	Per Cent	Mg.	Mg.	Mg.	Mg.	Mg.	Mg.
A	Olive base rubber	1.5	1.251	4.82	0.09	—	0.13	0.20	—	0.27
A	Olive base rubber	2.0	1.254	2.75	0.09	—	0.16	0.21	—	0.29
A	Olive base rubber	2.5	1.256	2.05	0.11	—	0.18	0.23	—	0.31
A	Olive base rubber	3.0	1.256	1.25	0.10	—	0.16	0.23	—	0.29
A	Olive base rubber	—	1.255	—	0.12	0.13	0.15	—	0.31	—
C	Metal filled base rubber	—	1.183	—	0.09	0.13	0.16	—	0.28	—
E	Pink veneer rubber	1.5	2.463	0.16	0.14	0.20	0.25	—	0.52	—
E	Pink veneer rubber	2.0	2.465	0.11	0.14	0.17	0.21	—	0.44	—
E	Pink veneer rubber	2.5	2.469	0.06	0.11	0.15	0.18	—	0.34	—
E	Pink veneer rubber	3.0	2.471	0.05	0.10	0.14	0.17	—	0.32	—
E	Pink veneer rubber	—	2.481	—	0.14	0.17	0.21	—	0.36	—
F	Pink rubber	—	1.960	—	0.17	0.21	0.25	—	0.52	—
G	Vinyl resin	—	1.355	—	0.13	0.14	0.16	—	0.17	—
H	Phenol-formaldehyde resin	—	1.326	—	0.25	0.29	0.32	—	0.51	—
I	Cellulose nitrate compound	—	1.368	—	1.65*	1.13*	1.57*	—	—	—

*These values for gain in weight are low because of partial solution of the sample during the experiment.

obtain greater sensitivity in measuring the fiber stresses.

It is not well understood why materials fail under repeated stresses much below their maximum strength, but it is a fact that has been demonstrated for many materials. Dentures are subjected to repeated stress in chewing. The magnitude and the number of stress cycles developed in using dentures is not known, but a simple calculation indicates that it is not unreasonable for a denture to be subjected to several million cycles of stress. Determination of the endur-

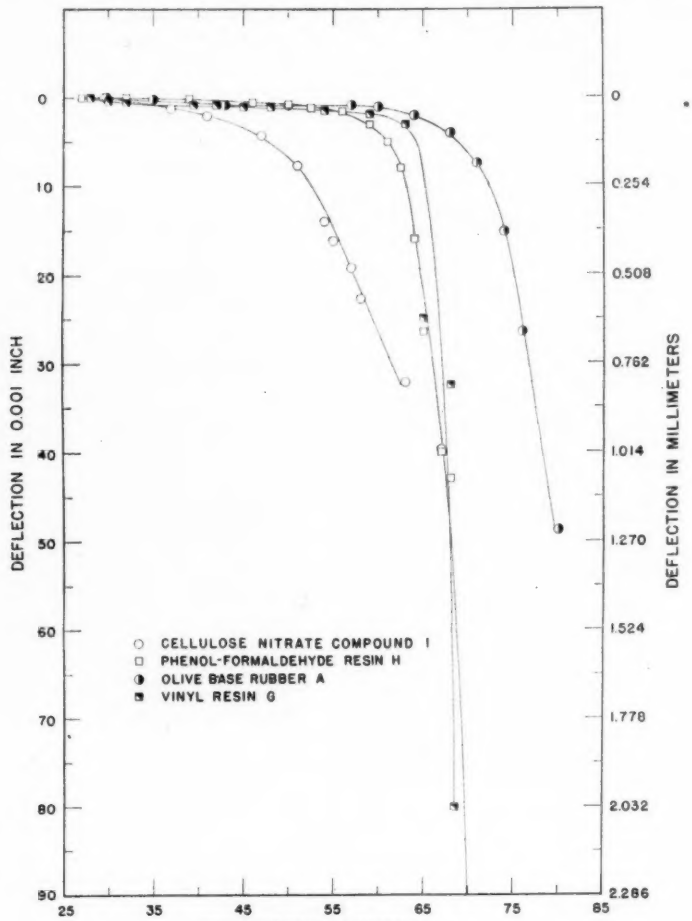


Fig. 5.—Curves on bending of denture materials.

ance limit, which is the maximum stress at which a sample will withstand an indefinitely large number of flexures, is a very slow procedure. Available information on the endurance limit of the resins is almost nil. Endurance limit tests have been almost wholly confined to metallic materials. Here, we are dealing with plastics, which are characteristically different.

There is evidence that some of the failures of dentures in the mouth are caused by the low endurance limit of the material. It is also felt that other properties, such as internal strain incorporated in the denture during processing and fabrication, may be partially responsible for this type of failure.

The determination of the practical endurance limits of all four types of denture materials included in this report, as far as the dental use of these materials is concerned, has not been completed. The results obtained indicate that the phenol-formaldehyde resin H and olive base rubber A have definitely higher endurance limits than vinyl resin G, although the value for the latter material is much improved over the material tested in the previous report.[1] The producers of vinyl resin have indicated that they expect soon to place on the

Table 7.—Free Sulphur and Combined Sulphur in Denture Rubber After Vulcanization (Olive Base Rubber A)

Specimen	Vulcanized			Free Sulphur	Combined Sulphur
	Temperature		Time		
	C.	F.	Minutes	Per Cent	Per Cent
1	27	80	0	28.7	0.0
2	160	320	60	25.4	3.3
3	160	320	75	25.2	3.5
4	160	320	90	21.8	6.9
5	160	320	105	16.1	12.6
6	160	320	120	12.2	16.5
7	160	320	135	7.0	21.7
8	160	320	150	5.8	22.9
9	160	320	165	4.4	24.3
10	160	320	180	3.8	24.9

Table 8.—Volume Change of Dental Rubber Vulcanized Two Hours at 170 C. (338 F.)

Sample	Material	Before Vulcanization		After Vulcanization		Volume Shrinkage
		Specific Volume	Density	Specific Volume	Density	
		$Cm.^3/G.$	$G./Cm.^3$	$Cm.^3/G.$	$G./Cm.^3$	Per Cent
A	Olive base rubber	0.858	1.165	0.799	1.251	6.8
C	Metal filled base rubber	0.894	1.119	0.855	1.169	4.5
D	Maroon rubber	0.584	1.711	0.572	1.747	1.5
E	Pink veneer rubber	0.426	2.347	0.409	2.443	3.8

market a material with higher fatigue resistance than that previously supplied.

4. *Thermal Conductivity.*—Thermal conductivity measurements were made by M. S. Van Dusen of this Bureau on sheets of denture material approximately 125 mm. square in a standard type of hot plate conductivity apparatus. (Fig. 3.) Three samples of different denture base materials were placed in series on one side of the hot plate and a slab of cork board of known conductivity was placed on the other side. The sheets under test were separated by soft rubber. Thermocouples were attached to the faces of the samples. When a steady state of heat flow was attained, the rate of flow through all three specimens was the same. Their relative conductivity was calculated from the temperature gradients in the specimens. The test specimens available were too thin (4 mm., approximately) to permit of accurate measurements, but any significant differences in them would be easily detected. The absolute value was obtained by calculating the total heat flow through the cork and subtracting it from the heat supplied to the hot plate and are accurate to better than 10 per cent. The results of these tests are given in Table 4, together with the thermal conductivity values for several other materials.

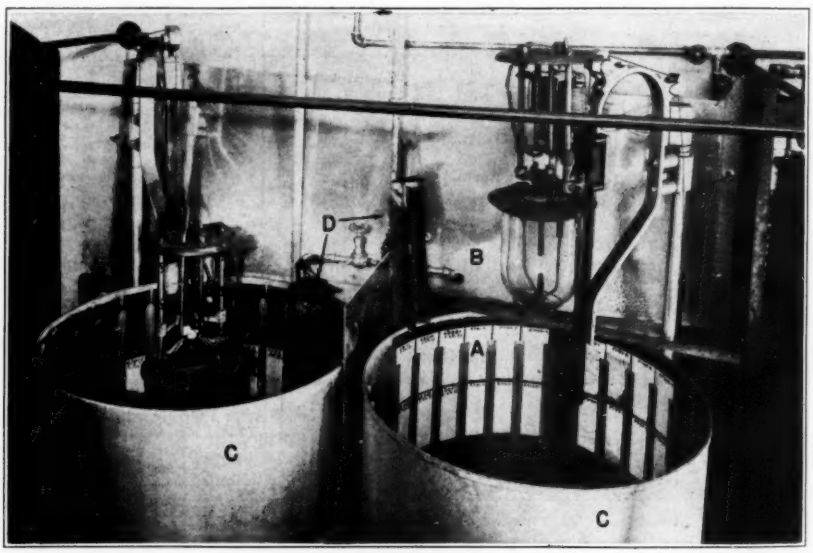


Fig. 6.—Light exposure equipment. *A*, specimens; *B*, carbon arcs; *C*, revolving drum; *D*, water spray.

Many dentists believe that a material having a high heat conductivity is more conducive to tissue health than one having a low conductivity. Examination of the table shows that resinous denture-base materials are very poor heat conductors when compared to metals. It is interesting to note that metal-filled base

rubber C has, for all practical purposes, the same heat conductivity as other rubbers. This rubber was advertised as having a higher heat conductivity, owing to the contact of the aluminum particles.

5. *Bending Properties.*—The effect of heat on the transverse bending of four denture materials was studied by using a very simple apparatus. (Fig. 4.) A bar of the material (2.5 by 10 by 65 mm., approximately) was placed in two stirrups mounted on flexible self-alining supports 50 mm. apart. A 50-gm. weight was suspended from the center of the span. The mounted specimen was then immersed in a water bath and observations were taken on the bending of the specimen as the bath was heated. The deflection of the specimen was measured on a dial gage as the water bath temperature was raised approximately 1.5 degrees C. (2.7 degrees F.) per minute. Test results on four denture materials are shown in Figure 5. This shows the possibility of deforming these denture materials by chewing while they are in contact with very hot food or by cleaning with hot water. The specimens tested were the same nominal size as the impact specimens. Modified tests were later conducted with the same procedure except that the water bath was held at a constant temperature and the deflection was measured against time. This procedure can be more easily duplicated, but further experimentation is needed to establish the most suitable size of specimen and weight to give the desired sensitivity.

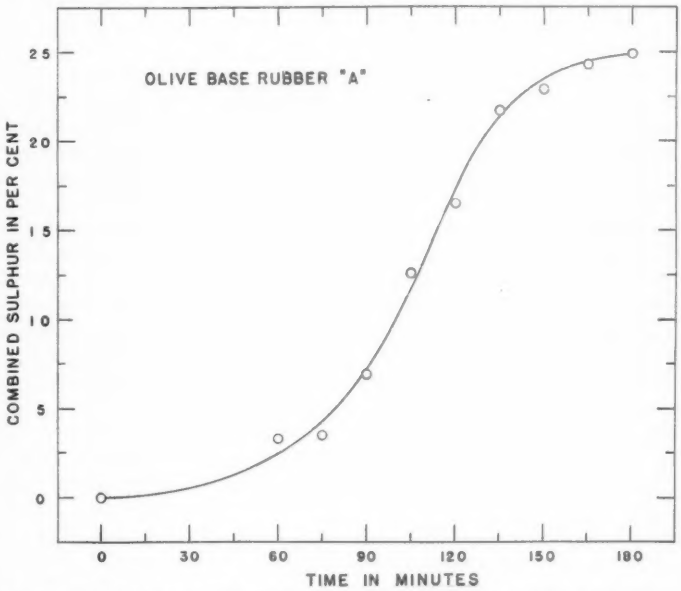


Fig. 7.—Rate of combination of sulphur with rubber hydrocarbon during vulcanization.

By the foregoing procedure, no differentiation is made between the elastic and the plastic deformation. Experi-

ments are to be made in which the elastic deformation will be determined. It is important to know what portion of the total deformation is plastic, because this is a measure of the permanent set.

Cold flow: Preliminary tests on plastic flow using the McBurney[2] Indentation Hardness Tester indicated that the thermoplastic materials had a greater cold flow at mouth temperature than thermosetting materials. This would be expected and shows why some dentures made from thermoplastic materials (such as cellulose nitrate compounds) are liable to warp unless designed with heavy sections.

This type of test gives a much better comparison of the surface hardness of dentures than tests that depend on the application of the load for a stated time. By this method, with a suitable adjustment of the load to the diameter of the ball, the rate of plastic deformation can be observed for a relatively short interval of time and, from these observations, the flow over a long period of time can be calculated.

6. *Color Life.*—The change in color of denture materials may be due to many conditions, such as chemical instability and absorption of material. Samples were placed in an apparatus[3] (Fig. 6) used for studying the weathering effects of paints, varnishes, etc. The specimens are exposed to the radiation of a regulated carbon arc. Tests indicated that samples of different denture materials may show marked changes in color when exposed to light for long periods of time. Samples of vinyl (*G*) and phenol-formaldehyde (*H*) resins showed a greater change in color than the rubber specimens (*A, C, D, E*) or the cellulose nitrate Compound I, after thirty-six hours' exposure. The ratings were made by visual inspection.

2. McBurney, J. W.: Indentation of Asphalt Tile, Am. Soc. Test. Materials, 24, Part II, 1934.

3. Walker and Hickson, Bur. Stan. J. Res., 1:1 (July) 1928.

CHEMICAL PROPERTIES

1. *Chemical Analysis.*—In an investigation of denture materials in which physical properties are studied, it is important that these properties be correlated with the chemical composition of the materials studied. With this in mind, a partial chemical analysis of rubber denture materials has been made. Because of the complicated nature of these materials and the necessity of modifying many of the available methods to the particular type of denture under investigation, sufficient time has not been available for making complete chemical analysis of all the materials studied. The results of a partial analysis of five typical rubbers used for dentures are given in Table 5. The procedures outlined in Federal Specification for Rubber Goods No. ZZ-R-601 were followed for these analyses.

2. *Sorption of Water by Denture Materials.* — Preliminary experiments have been made on the sorption of water by various denture materials. This work was undertaken for a twofold purpose: to obtain information on the cause of unsanitariness of denture materials and to study known defects of these materials before and after the sorption of water.

For these experiments, specimens were prepared of a definite size (2.5 by 10 by 65 mm., approximately) and the surface finished with No. 000 emery paper. The procedure adopted was as follows: Specimens were dipped in alcohol, then in ether to remove surface water and any oil film that may have been present, weighed immediately and immersed in

water in a closed container at room temperature.

The specimens were removed from time to time, and, after the surface water was again removed by dipping in alcohol and ether, weighed. Any gain in weight was attributed to sorption of water.

The results of these experiments for a period covering twenty-two weeks are given in Table 6.

These results should not be interpreted to mean that those materials that show marked increases in weight will necessarily produce unsanitary dentures. Experiments will attempt to correlate known defects with the sorption of water. It is to be expected that materials that show a high sorption will also show a marked change in physical properties under ordinary oral conditions.

The free sulphur content of two types of rubber vulcanized for various lengths of time (from 1½ to 3 hours at 160 C.) (320 F.) under identical conditions was determined. Results of sorption measurements made on these samples indicated that the amount of water taken up was not materially increased or decreased by the degree of vulcanization as determined by the free sulphur content.

3. *Rate of Combination of Rubber with Sulphur.*—The combination of sulphur with rubber hydrocarbon can be used as a measure of the degree of vulcanization. The rate of combination of sulphur with rubber hydrocarbon in a sample of olive base rubber A during vulcanization is shown in Table 7. The sample was vulcanized in a thin sheet under pressure and specimens were removed at fifteen-minute intervals between sixty and 180 minutes. The amount of free sulphur left in the specimen was determined by extraction with acetone.[4] The rate of combination of sulphur can be seen in Figure 7. The free sulphur was decreased from 25.4 per cent to 12.2 per cent in the first hour after reaching 160 C. (320 F.). It gradually decreased after this time; which indicated that the main part of the vulcanization was over in approximately one hour after a temperature of 160 C. was reached.

4. *Volume Change on Vulcanization.*—Some preliminary determinations on the volume change incident to vulcanization were made by vulcanizing a sheet of uncured rubber as received from the manufacturer between aluminum plates in a dental vulcanizer for two hours at 170 C. (338 F.). The results indicate that all samples show a shrinkage. The high filler rubbers shrank less than the olive base. This is in accord with the results reported by Snow,[5] which were obtained by an entirely different method. The samples in this experiment were weighed and their volume was determined both before and after vulcanization. The results of these tests are given in Table 8. These values are to be considered as approximate until more extensive experiments are carried out.

SUMMARY

1. This report, a continuation of a previous report[1] on denture base materials, deals with tests of the following representative materials: vinyl resin, phenol-formaldehyde resin, a cellulose nitrate compound and four types of dental rubber: olive, maroon, pink-veneer and metal-filled.

2. The cellulose nitrate compound was characterized by a lower tensile strength, lower proportional limit, larger set and greater deflection when heated under load, and hence would

4. Federal Specification ZZ-R-601, February, 1930.

5. Nichols, I. J.: Prosthetic Dentistry, St. Louis, Mo.: C. V. Mosby Co., pp. 298-310.

probably be subject to greater distortion in the mouth than the other materials.

3. In the flexural fatigue tests, thermosetting materials had higher strength than those obtained for the thermoplastic materials; that is, they would withstand higher stresses for a given number of cycles.

4. The thermal conductivity of these resins was very low in comparison to that of metals.

5. The softening ranges were determined by means of a transverse bend test. Cellulose nitrate Compound I softened at appreciably lower temperatures than the three other types.

6. All materials tested increased in weight on immersion in water, and continued to increase in weight throughout the test, which extended over several weeks. This increase for the cellulose nitrate Compound I was very high in comparison with the other types studied.

7. The amount of free sulphur left in specimens of a rubber vulcanized for different lengths of time was determined. The decrease in the amount of free sulphur left in a specimen of olive base rubber indicated that the major part of vulcanization had occurred in one hour after a temperature of 160 C. (320 F.) had been reached.

8. All the rubbers tested showed volume shrinkage during vulcanization. The shrinkage was greater for the olive base rubber than for the rubbers that contained more fillers.

This progress report is presented in the hope that it may stimulate interest of manufacturers, schools and practitioners in the physical properties of denture base material.

WILLIAMS' CLASSIFICATION OF ANTERIOR TOOTH FORMS*

By M. RUSSELL STEIN, D.D.S., New York City

UP to two decades ago, anterior tooth forms were classified according to temperament. The nervous, sanguine, bilious and lymphatic were the four pure types. The obvious assumption behind this classification was that a close correlation existed between the peripheral outlines of the central incisors and the temperament. The classification took for granted a relationship between emotional and mental traits and such physical characters as the color of hair, skin and eyes.

The central incisor crown is fully formed and calcified at about the age of 5, when, according to the temperament theory, a definite connection is already established between the psycho-emotional patterns and the shape of the tooth. The temperament classification was probably an extension of the temperament theory that was popular with educational psychologists in the latter part of the nineteenth century. It was adopted by standard textbooks in prosthetic dentistry and was taught in the dental colleges. The hold it had on the profession was strengthened by its commercial application in the classification of artificial teeth.

*Read before the International Association of Dental Research, Louisville, Ky., March 15, 1936.

The classification of anterior crown forms is a commercial necessity. Stock teeth for artificial dentures must be cataloged to facilitate retailing. The temperament arrangement was the best known method at that time. It afforded a simple solution to a practical problem and was therefore uncritically accepted by both manufacturer and consumer.

For the pudgy, pale-faced bookkeeper with a low I.Q. and feeble pulse, the lymphatic type of tooth was indicated. For the buxom, blue-eyed matron of "chestnut hair" and "animated countenance," the sanguine incisor was called for. "The bilious temperament is characterized by black hair, a dark, yellowish, or brown skin, black eyes, moderately full, but firm muscles and harshly expressed forms. Those endowed with this constitution have a strongly marked and decided expression of countenance, they manifest great general activity and functional energy."[1]

If there appeared at the dental office an edentulous, emaciated, long-faced housewife of delicate health, who had spent her last score of years in the perpetuation of the human race without the benefit of domestic servants, the nervous type of tooth was used. Had the same person appeared in the bloom of her youth, she would probably have rated a sanguine tooth. The pure types were rare. The dentist experienced some difficulty in classifying the numerous in-between cases. But, in spite of this, the temperament classification was a very serviceable invention. It simplified inventories at the termination of the calendar year and it gratified man's deep and inarticulate passion for finding correlations in nature.

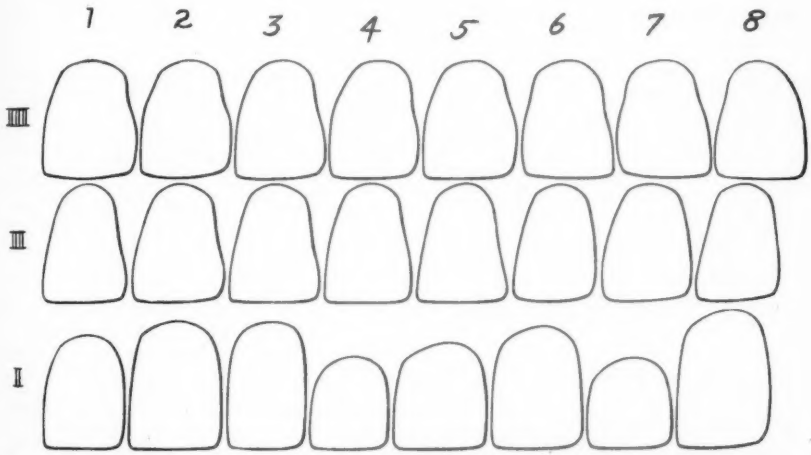


Fig. 1.—Reproduction of Williams' original illustration of variations in three primary types.

But the reign of the temperaments was not eternal. It met with an abrupt end in March, 1914, when J. Leon Williams published a lengthy and somewhat melodramatic paper entitled, "A New Classification of Tooth Forms, with Special Reference to a New Sys-

1. Wilson, G. H.: Manual of Dental Prosthetics, Philadelphia: Lea and Febiger, 1920.

tem of Artificial Teeth."[2] With an impressive array of original observations, Williams demolished the temperament theory. He showed that the two leading dental supply firms had different interpretations of the temperaments. "Please compare the corresponding types of the two manufacturers," wrote Williams. "No comment from me is necessary, and I will make none."[3]

He also disproved that there was any connection between the shape of the teeth and the shape of the skull. He demonstrated the existence of narrow skulls with wide teeth and wide skulls with narrow teeth, long faces with short teeth and short faces with long teeth. He drove home his arguments with quotations from Omar Khayyam on the "sorry scheme of things" and Haekel on the ungodliness of the human physiognomy.[4] Williams terminated his annihilation of the temperament classification by pointing out its inconsistency with the facts of heredity. He quoted Mendel, Weissman, Galton, Thompson and Bateson. "One child may inherit the general facial peculiarities of the father and the complexion, color of eyes and hair, and the teeth from the mother."[5]

If, as Williams proved, temperament, cephalic index and facial outline were not correlated with the shapes of the incisor teeth, only one conclusion was possible: Any scientific classification of tooth forms must be based upon the morphologic characteristics of the teeth themselves and must be expressed in geometric and not physiologic or psychologic terms. It must be such that every classifier, no matter in what part of the world, would independently place a given tooth in the same category. Williams' classification fulfilled this requirement. It divided central incisors into three categories:

Class I is characterized by parallel or nearly parallel lines which represent the proximal surfaces of these teeth for half or more than half of their length from their incisal edges. In Class II these lines converge so markedly that they would meet in most instances, at a point near the end of the root. These converging lines are

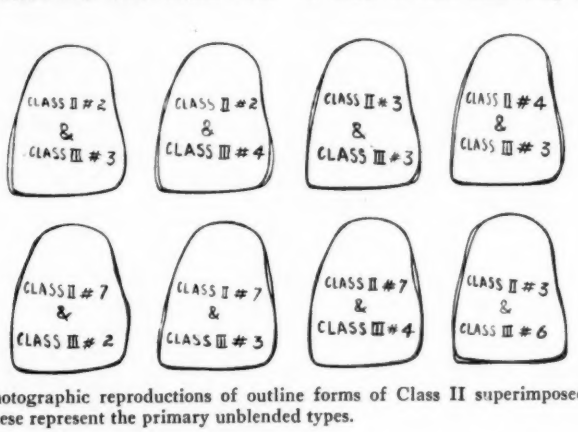

CLASS II # 2 & CLASS III # 3
CLASS II # 2 & CLASS III # 4
CLASS II # 3 & CLASS III # 3
CLASS II # 4 & CLASS III # 3
CLASS II # 7 & CLASS III # 2
CLASS II # 7 & CLASS III # 3
CLASS II # 7 & CLASS III # 4
CLASS II # 3 & CLASS III # 6

Fig. 2.—Photographic reproductions of outline forms of Class II superimposed on those of Class III. These represent the primary unblended types.

2. Williams, J. L.: J. Allied D. Soc., 9 (Jan.) 1914.
3. Footnote 2, p. 10.
4. Footnote 2, p. 11,
5. Footnote 2, p. 13.

sometimes nearly straight, but usually there is a slight convexity of the mesio proximal surface and a slight concavity of the distal surface. Class III, which I regard as the most beautiful form of human teeth, is characterized by a delicate double-curved line on its disto-proximal surface and sometimes, though less frequently, on the mesial surface. All of the surfaces and angles of the teeth of this class are more rounded and graceful than in either of the other two classes.[6] (Fig. 1.)

Williams stated that he found these three types to be "fundamental."

A large dental supply firm used Williams' observations as a basis for the manufacture of a new series of artificial teeth. Their introduction on the market was hailed as a great step in progress over the temperament series. The new forms were popularized as the square, the tapering and the ovoid, and, for the more obtuse consumer who could not perceive the implications of harmony and perfection in these terms, the pure types were characterized by a square, a triangle and a circle. With classic dignity, advertisements bore these three geometric figures in appropriate proximity to a Greek statue.

The origin of Williams' classification dates back to about 1909, when Dr. Williams, according to his biographer, George Wood Clapp, began his negotiations with the dental manufacturing company. The company "made an agreement with Dr. Williams that if he would secure from the rank and file of the profession satisfactory evidence of interest in a determined effort to improve the forms, it would produce the system of artificial teeth which he proposed."[7] And to quote further from Dr. Clapp's biography, the most difficult decision in the whole course of the work was what forms should be selected for the system as "they must be few in number and meet a multitude of needs."[7] Thus, the commercial influence in the origin of the classification imposed on it, from the start, two important limitations. The classification had to meet with the approval of the rank and file and the categories had to be simple and few. It is very difficult to overlook the bearing these limitations had on Williams' writings. In 1914, he wrote: "To teach a theory which no one really practices or understands is immoral because it leads directly to a disbelief in any scientific basis for prosthetic dentistry."[8] It is quite obvious that most new theories, at the time of their inception, are both misunderstood and unpracticed. It is also obvious that the popular level of understanding is certainly no criterion for the judgment of the truth of a scientific theory. The author of this statement was undoubtedly unconscious of its motivation. Later, Williams made the discovery that there were only three fundamental types, with slight modifications thereof.

As a practical commercial project, the work of Dr. Williams was admirable. He contributed to the profession a system of classifying artificial teeth that was far superior to any of its predecessors. But Williams further sought to substantiate his classification by attaching to it an anthropologic importance. Now his investigations on the classification of anterior tooth forms are authoritatively quoted by physical anthropologists. One must therefore ask certain important questions concerning this classification. To what extent are they arbitrarily selected? If there is a strong element of

6. Footnote 2, p. 19.

7. Clapp, G. W.: Life and Work of James Leon Williams, New York: Dental Digest Publishing Co., 1925.

8. Footnote 2, p. 27.

personal interpretation in his classification, are there any other artificial classifications that would serve as well or better?

Williams not only refers to his three fundamental types as "natural divisions" but also as "Nature's ideals." The story of their discovery cannot be told more vividly than by Dr. Williams himself:

> As I proceded in the work it became evident that, after a time, I was accumulating three very strongly marked groups—when I finished arranging my incisors in this way I again went to the Museum of the Royal College of Surgeons to see what light this discovery would throw on further studies there. I was more than a little surprised to find these three types of teeth in almost every group of skulls which contained a dozen, or even less, with the incisor teeth intact. My long search for something fundamental had been rewarded. I had at last got what I was after—the key to tooth form. All along I had seen that there were different types of teeth in all the different races, but the co-relation of these different forms had never struck me until I went there with the knowledge of what to look for. When I saw clearly that these three types of teeth existed in all races, I knew instantly that I had got Nature's secret of design in human teeth, and I knew that it would be possible to beat her in her own work; for Nature, working blindly, makes endless mistakes as I have previously indicated, while we, working intelligently, can avoid these mistakes. I saw that the existence of three types of teeth was the fundamental fact in human tooth form and that every conceivable form of human tooth could be evolved from those three types, and I knew that it would be possible to design beautiful and anatomically correct forms of teeth if I never saw a human tooth again.[9]

Thus, Williams regards the variations in nature as the endless mistakes of a personified "Nature." He believed that Nature designed all teeth upon three simple geometric outlines and that she tried hard for over a million years to execute her plans, but really couldn't do it as well as dentists, who somehow or other happened to get hold of the original blueprints. With his three typal forms, he pulled together the ends of the curve or morphologic variation and improved on Nature by diminishing variability.

Dr. Williams, in quest of pure types, found the answer in simple geometric patterns. If he had associated the concept of purity with the curves of analytic geometry, he might have discovered that the ellipse, parabola and hyperbola were the basic forms of incisor teeth. And it probably would have been just as inevitable that Nature select the conic sections as her motive in tooth design. Or if his training was primarily anthropologic instead of dental, he might have used the length-breadth index as a basis for classification, namely, brachydont, mesodont and dolichodont. The variation of central incisors is so great that many classifications are possible. Williams appreciated this variability, but he used it only to disprove another theory. He wrote, "Please observe that when the teeth are not all good examples of the primary forms of their class, yet the variation in form is so great as to upset the theory of a racial type of tooth."[10]

An analysis of Williams' original diagrams of his pure type casts doubt on Nature's passion for euclidian geometry. Figure 1 is a reproduction of Williams' drawing which he entitled, "Variations in three primary types." These outlines represent the unblended basic forms. They have been numbered for convenience from 1 to 8. In Figure 2, photographic enlargements of some of the pure

9. Footnote 2, p. 16.

10. Footnote 2, p. 22.

types of Class I have been superimposed upon those of Class II. The differences in all eight illustrations are insufficient to warrant placing them in two different classes when there are only three divisions. It is interesting to note that there is practically no difference between Class II, No. 2, and Class III, No. 3.

Although Dr. Williams based his classification upon the outlines of the labial surfaces of anterior teeth, he claimed that "the other teeth in any given set partake of the features of the central incisors but to a much less marked degree."[10] "But in this respect," he continues, "the natural teeth of a given set are not always in harmony. . . . The crossing of races or some other cause often disturbs the harmony of line of the different teeth in a set, and you may sometimes find central incisors of one class and laterals and canines of another." Just two pages previous to this statement, he struck the keynote of his thesis with the contention that "there is no such thing as a racial form of tooth."[11] And further, "This mistake concerning racial types of teeth has grown out of insufficient critical observation."[12]

Williams explains disharmony by a crossing of the races, thus implying that there must have been something distinctive about either or both of the two races that were mixed. He then made a "significant discovery." "When I made a thorough examination of the teeth of the lowest and most primitive races, finding everywhere three distinct forms, it occurred to me one day that the teeth of the anthropoid apes might throw some light on the question of the original of types."[13] He investigated the anthropoids and once again found squares, triangles and circles. And this, asserted Williams, was "one of the most striking homologies that has ever been discovered between man and the anthropoids."

It is well to point out here that the variation of outline forms of the central incisors in every species of primate is extensive. His pattern of conception, or *gestalt,* automatically placed the variations in his three fundamental types. He suggests a man who looks through a red glass and makes the amazing discovery that man and the anthropoids are red!

He submitted this observation to noted men of science for approval. Among these were Henry Fairfield Osborn, Sir Arthur Keith, Smith-Woodward, A. Russell Wallace and Ernst Haeckel. Dr. Williams wrote of Ernst Haeckel, his most enthusiastic correspondent, that he "is admittedly the greatest authority who has ever lived in matters of comparative morphology in man and the lower animals."[14] Huxley held that Haeckel's "Comparative Morphology" was "one of the greatest productions in the history of science." Charles Darwin said that if he had read this book before he began the "Descent of Man," the latter would never have been written. Dr. Williams then recorded the letter he received from Haeckel:

Dr. Leon Williams,
London.

Dear Sir: Your observations on the three different types of upper central incisors are very interesting, and mainly the fact that the same three characteristic types occur also in the orang-outang and in other anthropoid apes. In my opinion this fact is another new and convincing proof for the near relationship between man and the anthropoid apes, and for the phylogenetic theories that both have been derived from one and the same common ancestor. First, the fact that these three

11. Footnote 2, p. 17.
12. Footnote 2, p. 23.
13. Footnote 2, p. 29.
14. Footnote 2, p. 30.

types—in physiological relationship of little value—are so distinctly developed in three morphological directions, seems to me an important proof that the way of phylogenetic divergence of characters is the same in man and in the anthropoid apes.

Very respectfully yours,
Ernst Haeckel [15]

Williams comments: "With what admirable clearness and conciseness Professor Haeckel's masterful mind has gone straight to the mark in that letter."[15]

Up to this point in his paper, Dr. Williams was very certain that his three distinct types were "natural" and "fundamental." Then, to prove some point about his new artificial teeth, he wrote, "Out of the vast confusion of imperfection of nature we have to isolate, as far as we can, the pure elements of truth and beauty in tooth form."[16] This statement indicates that Williams had a preconceived idea of what "truth and beauty" were in central incisors, and, as he himself wrote, knowing what to look for, he found it.

There are other inconsistencies appearing at the end of his paper. One of the strongest arguments he built up against the temperament theory was his demonstration of the disharmony between facial and tooth forms. Then, with a puzzling indifference to what he had just written, he resolved the problem of artificial teeth to one of harmony.

I can hardly repeat too frequently that the whole problem is an art problem. . . . Every one who has had experience in this field knows that if he were to place a set of oval teeth in a mouth of a person who had a very square face, or a set of long teeth in a very short face, the disharmony or falseness would be alarmingly evident.[17]

Williams claimed that his system was an improvement on Nature. He followed Nature's methods, but excluded her "eccentricities and grotesqueries." On page 39,[2] he stated that he had to alter these natural conditions to produce harmony. On page 42,[2] he says, "Harmony is the very first essential of naturalness."

Williams assumed that because he had disproved the temperament theory, he had proved his own. In his conclusion, he wrote, "The facts that disprove the temperamental theory are the facts upon which the new classification is based."[18] This is not the case. Every argument he used to disprove the temperament and racial type theories, he later refuted in order to prove his own. It is upon such a theory, factually, graphically and logically inaccurate, that physical anthropology depends for any authoritative interpretations concerning the teeth of man.

In this one paper, Dr. Williams exhibits three phases of character. At the beginning, Dr. Williams, the scientist, forcefully criticized and destroyed the temperamental and racial type theories. In the middle third, Dr. Williams, the philosopher, built up his own classification in an eloquent emersonian style. In the concluding third, Dr. Williams, the artist, discarded his science and philosophy and resolved the tooth problem to one of esthetics.

630 West One Hundred and Sixty-Eighth Street.

15. Footnote 2, p. 31.
16. Footnote 2, p. 33.
17. Footnote 2, p. 34.
18. Footnote 2, p. 35.

LESIONS OF THE MOUTH FROM SENSITIZATION TO BASE PLATE MATERIAL*

By HERBERT RATTNER, M.D., Chicago, Ill.

IN recent years, there has accumulated a considerable literature on the subject of lesions of the oral cavity that are the result of hypersensitiveness. The cases fall into two groups: one in which lesions are produced by the local action of irritants in contact with the mucous membranes, as from some dentifrices, producing "contact" stomatitis; the other in which the lesions are of systemic origin, as from the ingestion of certain drugs. The purpose of this report is to call attention to a new source of irritation that has caused several cases of "contact" stomatitis.

To develop this sort of lesion, two conditions are necessary, the action of an irritant and the element of hypersensitiveness. It has long been recognized that only persons who are peculiarly susceptible will react abnormally to certain agents. To the vast majority, these agents are harmless, hypersensitiveness developing in only a few. Despite the intensive study that has been given the subject, it is not yet known why or how some persons became sensitized, although there is a good deal of plausible speculation. Other important facts[1] have been learned. It is recognized that hypersensitiveness may be either inborn or acquired. In the greater number of persons, it is acquired. In some, very soon after contact with an irritant; in others, only after repeated contacts over a long period of time. It is known also that a person may be abnormally sensitive to one irritant only or to numerous irritants. And, of greatest importance, it has been established that, in the skin, hypersensitiveness does not necessarily affect the entire body surface: it may be limited to a circumscribed area. It is likely, therefore, that susceptibility can be limited also to the mucous membranes of the oral cavity. It has been noted too that, in a large proportion of the cases, there is a family history of disease such as hay fever and asthma. Also, it was formerly thought that only protein materials could produce reactions; but now it is recognized that hypersensitive tissue can be irritated by almost anything: animal, vegetable, mineral or chemical matter. It is thus evident that a great deal of important and useful information has been accumulated, though it is not yet known what first causes hypersensitiveness to develop.

The reactions that are produced in the mouth are of an inflammatory nature, and clinically the picture that is produced is variable and is not characteristic. It may range from a diffuse catarrhal stomatitis, mild or severe, to discrete erosive or ulcerative (aphthous) lesions. Subjective symptoms are always present, and the burning, stinging or painful sensations may vary in intensity. In many

*From the service of F. E. Senear, Department of Dermatology and Syphilology, University of Illinois College of Medicine.

1. Pusey, W. A.: Tr. 8th Internat. Cong. Derm. & Syph., 1930, p 126.

cases, the reaction does not take place until some time has elapsed, even days after the tissue has been irritated. This latent period varies in different cases, depending on either the person affected or the offending agent.

DATA EMPLOYED IN DEALING WITH LESIONS DUE TO HYPERSENSITIVENESS

I. Systemic	Foods		
Diagnosis usually by history, and if necessary percutaneous skin tests (usually, though not necessarily accompanied by a cutaneous eruption)	Drugs*	Acetanilid-antipyrine group	Empirin Pyramidon Analgesin
		Barbital group	Veronal Luminol Codeonal Bromurol Trional
		Salicylic acid group	Sodium salicylate Salol Aspirin Oil of wintergreen Salipyrin
		Halogens	Iodine compounds Bromine compounds
		Arsenicals	
		Quinine	
		Unclassified synthetic drugs	Cinchophen Atophan Hexamethylenamin Phenolpthalein†, which is contained in more than 125 proprietary preparations, put up in form of laxative drugs, ("Ex-Lax"), chewing gums ("Feenamint"), confections, pink icing on cake, pink mouth wash and dentifrices, etc.
II. Local	Dentifrices		
Diagnosis by history and patch tests (not accompanied by a cutaneous eruption)	Plates—synthetic substitutes for vulcanite		

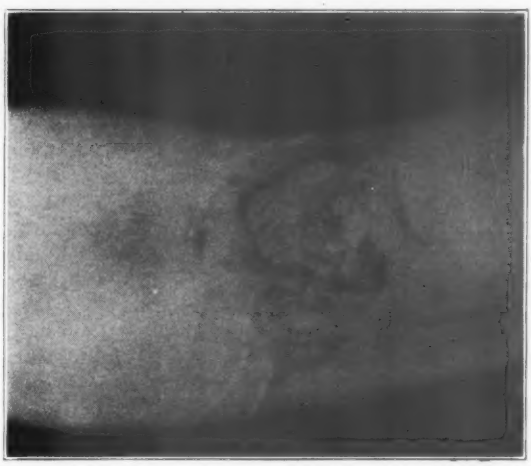
*Prinz, Hermann, and Greenbaum, S. S.: Diseases of Mouth and Their Treatment, Philadelphia: Lea & Febiger, 1935, p. 420.

†Newman, B. A.: Phenolphthalein Intoxication, J.A.M.A., 101:761 (Sept. 2) 1933.

In the diagnosis of these conditions, an accurate, intelligent history, brought

out by repeated and pointed questioning, is of greatest value. Usually, the history alone will suffice to solve a case. Often, it is learned that the lesions in the mouth appeared after a laxative was taken. In such a case, the patient should avoid the drug until the lesions have healed, and then use it again, and if there is a recurrence of the lesions, the evidence is rather conclusive that the drug is at fault. Occasionally, a simple clinical test of this kind is insufficient, and recourse must then be had to skin tests, either scratch, intradermal, passive transfer or patch tests.

The patch test is the most useful test in those cases in which the stomatitis is due to contact with the irritant, the sort of stomatitis with which this report is concerned. The aim with a patch test is to imitate as nearly as one can the conditions under which the stomatitis occurred. A piece of gauze about 1 inch square is saturated with the material that is suspected of irritating the patient; for example, a mouth wash. The saturated piece of gauze is placed on the inner surface of the upper arm, where the skin is thin. The gauze is then covered with a larger piece of waxed paper or guttapercha, and over this is strapped adhesive plaster to fasten the patch to the skin. It is removed forty-eight hours later and the skin is examined. If the reaction is positive, the skin under the patch will show an area of inflammation with redness, slight swelling and perhaps small papules or vesicles, and one may assume that the substance tested is the irritant, provided the material is one that will not give a positive reaction in too many normal persons. Verification should be made by a clinical trial, in which omission of the substance must bring about disappearance of the symptoms, followed by a recurrence of the symptoms when the substance is again used. Should the test be negative, the material tested cannot be freed entirely of suspicion because the mouth only, and not the skin, may be



Intense vesicular reaction occurring on skin of arm of stomatitis patient when denture was strapped to arm for twenty-four hours.

sensitive. Of course, only substances should be used for testing that are known to be harmless to normal skins. One would never perform a patch test with a chemical caustic.

A practical variation of this test was recently performed on four patients. A woman[2] complained of stomatitis with burning tongue, a salty taste, increased salivation and nausea. She wore upper and lower full dentures, made of one of the newer base materials, said to be a cellulose. The symptoms began shortly after she acquired the new plates. Because her dentist and her physician could not account for the symptoms on either mechanical or medical grounds, it was thought that perhaps there was something in the base material to which she was sensitive. The plates were strapped to her arms (patch tests) and, in twenty-four hours, there was an intense vesicular reaction. On the skin of two normal persons, the same plates failed to produce any reaction. The patient removed the plates for one week and there was a decided improvement. When she again wore them, there was an immediate recurrence of acute stomatitis; which indicated rather clearly that she was sensitive to the denture material. Patch tests were made with the grindings of vulcanite, also vinyl resin, phenol-formaldehyde and cellulose bases, one of which was taken from an unworn denture of the same cellulose material as that which caused the irritation, while another was ground from the denture itself. All were negative. This fact in itself might be significant, as contact with the grindings from the irritating denture did not produce the same reaction as did surface contact with the whole plate. A change was made to vulcanite plates. She continued to have slight discomfort, but much less than with the original dentures. An examination then revealed a hypochromatic anemia and an absence of free hydrochloric acid in the gastric contents, which might account for some of the discomfort of the tongue. Again, a patch test with vulcanite was negative, and with the original dentures was positive; and again when the original plates were worn, there was a recurrence of the symptoms.

The case histories of the other three patients were essentially like the history of the first case except that, in all three, physical examinations were entirely negative. One case gave a positive patch reaction to one cellulose denture, another to a second cellulose product. The third gave a negative reaction to the base material, which was not identified—perhaps an example of local sensitivity. Of particular importance in all the cases was the fact that, in addition to positive patch tests, the symptoms disappeared when the plates were not worn and recurred when the plates were again used.

It then occurred to me that perhaps by means of patch tests one could determine before plates were made for a patient whether he would be sensitive to them. It was first necessary to learn whether the base materials when used in patch tests would irritate most people or only an occasional person. Ninety-eight dental students volunteered to be tested and were studied. Shavings were made of vinyl resin, cellulose, vulcanite and a phenol-formaldehyde product. Patch tests were performed with each of these, and in only one case was there a positive reaction—a reaction from vinyl resin in a student who gave a history of attacks of migraine. This low incidence of only

2. Rattner, Herbert: Stomatitis from Sensitization to Dental Plates, J.A.M.A., 106:2230 (June 27) 1936.

one in ninety-eight would seem to indicate that a positive reaction can be considered to have a good deal of significance, and that it might be a practical procedure to make a test before selecting material for plates.

It has long been known that occasionally soreness of the mouth develops from the wearing of dental plates. The subject has been fully discussed in dental literature, and the consensus of opinion apparently is that soreness of the mouth is due to a combination of conditions, such as a foreign body reaction with resultant abnormal circulation, poor heat conduction, bacterial infection from the accumulation of food débris, imperfect vulcanization and perhaps the poisonous action of chemicals used in the pigments. To these should be added, because it is not generally recognized, the fact that stomatitis may result from hypersensitiveness to materials in dental plates, particularly the newer synthetic substitutes for rubber plates.

SUMMARY

Lesions in the mouth that are the result of hypersensitiveness may be of systemic origin, or they may be evidence of a local reaction. They occur only in persons who are peculiarly sensitive to certain irritants. The results of patch tests with base materials on ninety-eight normal subjects and of four patients with stomatitis would seem to indicate that base materials for dental plates, especially the newer synthetic substitutes for rubber, should be added to the list of materials contact with which is capable of producing "contact stomatitis." The accompanying table has been useful in dealing with cases of lesions due to hypersensitiveness.

It must be remembered that the incidence of lesions from sensitization is very small when compared to the amount of the drugs that is used every day, and the number of plates that are worn with perfect comfort.

7 West Madison Street.

SIGNIFICANCE OF SYPHILIS TO THE DENTIST*

By PAUL A. O'LEARY, M.D., Rochester, Minn.

THERE are more misconceptions prevalent among nonmedical groups in regard to syphilis than there are known facts. This state of affairs is no doubt due to the fact that the tinge of indecency that has been associated with the disease has prevented public discussions and press publicity that would broadcast the known facts and dissipate the misinformation that is so common. It has been only recently that certain newspapers and periodicals have dared, so they felt, to print the word "syphilis," and it is indeed even now a sad commentary on our lack of progress that but few publications will use this word, but instead hold to such an archaic and meaningless expression as "social disease." Campaigns to publicize the facts about the disease that the layman should be

*From the Section on Dermatology and Syphilology, The Mayo Clinic.

*Read before Section on Medical Relations at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 18, 1936.

familiar with are necessary, and such publicity could readily be carried out as has been done in the case of cancer and tuberculosis.

Among the outstanding misconceptions is the one that syphilis is of Biblical age. Investigators have been unable to trace the disease farther back than the time that Columbus returned from his second trip to this continent. Accordingly, Haiti continues to bear the brunt of the accusations that syphilis originated there. Suffice it to say apropos of the origin of the disease that the evidence accumulated indicates that syphilis was brought back to Europe by the crew of Columbus, while the data indicating that syphilis existed at the time of Christ are so flimsy that they have not been accepted by science.

Time has done a great deal in overcoming the misconceptions that gonorrhea and syphilis were related, that syphilis was the outgrowth of chronic gonorrhea or that lack of attention to gonorrheal infection would result in syphilis. The recognition by Schaudinn in 1905 of *Spirochaeta pallida* as the organism responsible for the disease was the basis for the numerous new developments and the knowledge of the disease of the last two decades. The chancre has been accepted as the lesion that develops on the skin or mucous membrane at the point of entry of *Spirochaeta pallida* and, accordingly, it is recognized as the first clinical sign of the disease.

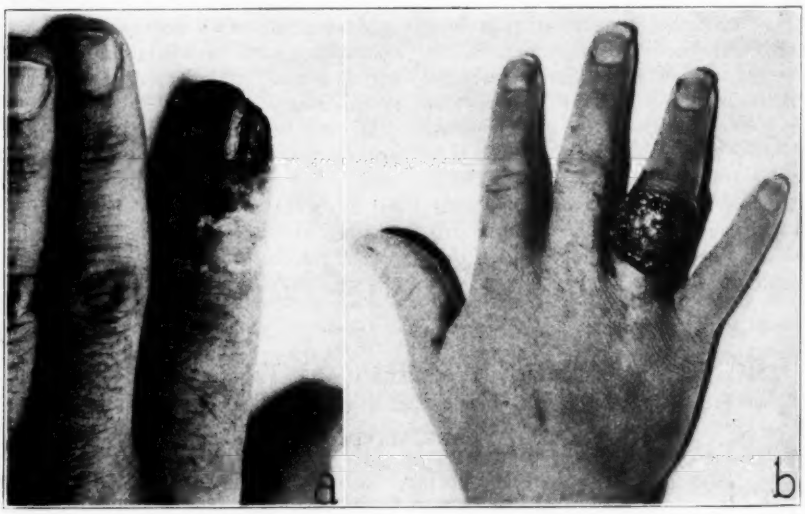


Fig. 1.—Chancre of finger.

A recent investigation has shown that a chancre does not always develop at the site of inoculation, as 38 per cent of the adult males who acquired syphilis did not have the so-called primary lesion. Certain of these patients may have had a chancre that was so small as to have passed unnoticed, as a chancre the size of the head of a common pin would readily pass as insignificant. It is seldom that a woman has knowledge of such a lesion owing, in

the main, to the fact that a chancre frequently develops on the uterine cervix and is painless. Sufficient data have been accumulated to warrant the statement that the onset of syphilis is not always manifested by a chancre and, accordingly, the patient with syphilis who denies knowledge of such a lesion is not necessarily falsifying. Laboratory investigations have shown that an abrasion of the skin is not essential to the entry of *Spirochaeta pallida,* and that a chancre may develop on unbroken skin or mucous membrane. Although the majority of chancres are located on or about the genitalia, many are encountered on other parts of the body, and these are known as extragenital chancres. The fingers (Fig. 1, *a* and *b*), lips (Fig. 2), tonsils, sides of the neck and, in fact, any part of the glabrous skin may be the site of the initial lesion of syphilis.

With the appearance of the chancre, the adjacent lymph nodes enlarge, this condition being known as bubo (Fig. 2). This is one of the earmarks of early syphilis; in fact, the presence of a bubo adjacent to a small ulcer or nodule should arouse the suspicion that the lesion may be the initial lesion of syphilis. I have purposely avoided a description of chancres because they are so varied in their clinical appearance that an accurate description of their many varieties is impossible, and, in addition, a clinical description would indicate that a clinical diagnosis was a simple procedure. The contrary is true, and the opportunities for diagnosing chancre by clinical means alone are rare. The search for *Spirochaeta pallida* in a scraping from the chancre or by aspiration from the bubo with the aid of the dark-field illuminator is the secure method of finding the lesion.

Fig. 2.—Chancre of lip, showing swelling of lip and bubo in left submaxillary region.

After the chancre has been present about a month, the so-called secondary phase of the disease develops, being characterized by lesions on the skin and mucous membranes. The presence of these lesions on the skin is evidence that *Spirochaeta pallida* has spread from the

chancre to the bubo, then to the blood stream and, in turn, to all parts of the body. These lesions on the skin may be very pronounced and extensive, and they may involve the entire skin; or they may, like the chancre, be so mild and evanescent as to pass unnoticed by the patient. It is again obvious why patients who have recently acquired syphilis will deny knowledge of the disease. These "secondaries," as they appear on the skin and mucous membrane, are self-limited. The milder types disappear quickly, but the extreme types may remain for many months and become extremely disfiguring, if not treated.

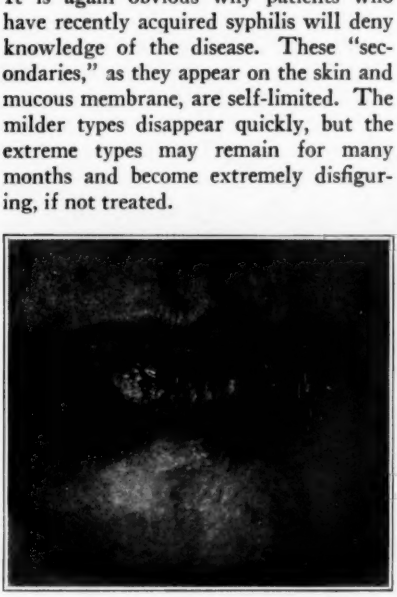


Fig. 3.—Mucous patch on lip.

The spontaneous disappearance of the lesions of the secondary phase, even though the patient is not treated, is evidence of the fact that the patient is developing his defensive forces against the disease. It is most unfortunate that this immunity reaction is not a permanent one in all cases, because, in the person in whom this reaction is temporary, lesions of the mucous membrane and skin will reappear, and they may continue to reappear and disappear spontaneously for many years. This is a most significant manifestation of syphilis, particularly to dentists, because these recurrent lesions appear in the mouth as small, superficial, painless patches that are highly infectious (Fig. 3). *Spirochaeta pallida* is readily demonstrated in one of these patches, so that the possibility of infectiousness that lurks in one of these lesions, especially to an oral worker, is in proportion to the degree of his suspicion. The more suspicious he is that the lesion may be syphilitic, the less the danger of his being infected; whereas, if he ignores

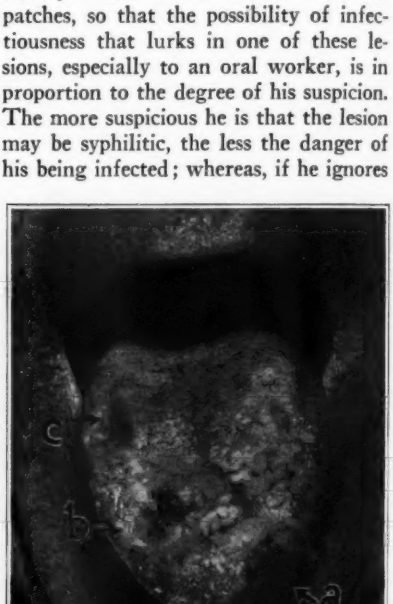


Fig. 4.—Syphilitic leukoplakia of tongue. Areas *a*, *b* and *c* have become malignant.

the lesion, the danger of infection is greatly increased. Accordingly, the dangerous phase of syphilis from the standpoint of infectiousness is the acute period. If the patient has recurrent secondary lesions, he is said to have a relapse.

The use of modern methods of treatment makes acute syphilis noninfectious. Within twenty-four hours after an in-

jection of arsphenamine, *Spirochaeta pallida* may be inactive, and, within sixty hours, the organisms have entirely disappeared from the mucous patches. Although one injection may produce this phenomenon, the best therapeutic results have been noted in those cases in which patients received at least thirty injections of arsphenamine and twice as many injections of a metal such as bismuth or mercury during the first year of the disease. Although adequate treatment of this type will result in a cure among 90 per cent of the patients so treated, inadequate treatment, by which I mean the use of only a few injections of arsphenamine or bismuth, usually results in a potentially infectious condition. As the organisms in the blood stream of a patient who receives an inadequate amount of treatment are not completely destroyed, reproduction of *Spirochaeta pallida* results in recurrence of the mucous patches. As stated previously, such lesions are infectious and are a source of danger to others.

It is fortunate that the majority of patients who are thoroughly treated respond readily and pass from the early to the so-called latent phase of the disease. As the term implies, latent or dormant syphilis is that phase during which no active signs of the disease can be found. Latency may start from the time treatment is given and may last the remainder of the patient's life, or latent syphilis may be that period in which the disease is progressing from the acute to the late manifestations. Accordingly, latency may be the end-result of adequate treatment, in the sense that no clinical signs of the disease ever develop and the patient lives a normal span of life in no way inconvenienced by the disease. On the other hand, a patient may proceed from the acute phase of syphilis to the latent phase, and because he has no symptoms nor signs of it, and because he feels very well, he soon forgets that he ever had syphilis. Unfortunately, in some of these cases, it is during this phase that the disease is making inroads on the central nervous system, the heart or large blood vessels or on some other vital structure, so that when the patient realizes that his health is not up to par, the disease has produced in these vital structures pronounced damage that is not readily reparable. The patient has been progressing slowly into the late phase, rather than, as he thought, remaining in the latent phase.

Accordingly, it is the practice of syphilotherapists to have a patient in whom latent syphilis develops report for examination at least once a year after he has completed the prescribed course of treatment. This examination should include a survey of the cardiovascular and central nervous systems, abdominal viscera, special senses, mucous membrane and osseous system, in search of evidence of syphilis. If such an examination reveals no signs of the disease, the patient is urged to return a year later for a similar study; if evidence of activity of the disease is found at one of these periodical examinations, treatment is outlined in accordance with the therapeutic procedure indicated for such a complication.

Latent syphilis is not infectious, nor is the advanced or so-called tertiary forms of the disease considered infectious. It behooves any one working in the mouth of a syphilitic patient to use the routine sanitary precautions that should prevail in a modern dental office, such as washing followed by complete sterilization of all instruments used on such patients, by boiling or by the use of a strong chemical, and thorough washing of the hands. The use of gases or fumes in an inert cabinet is a useless method of attempting to sterilize instruments. If the occasion

should arise when a patient with an acute infectious syphilitic lesion of the mucous membrane is in need of emergency dental care, the operator, as well as his assistants, should wear rubber gloves, use great caution to avoid trauma to the hands while working in the mouth, and thoroughly sterilize all equipment by boiling it for ten minutes when treatment is finished. It is more advisable for both the patient and the dentist to avoid undertaking any procedures when the lesions of acute syphilis are present, unless an emergency exists for which treatment must not be postponed. Such occasions are rare. The safer procedure is to have the patient treated at once with the specific remedies, which are to be continued until his physician believes treatment has been sufficient to render the disease noninfectious and to prevent complications developing in the patient's mouth subsequent to the trauma created by the dentist.

In the late or tertiary phase of syphilis, there are certain manifestations in the mouth that are of importance to the dentist from the diagnostic standpoint as well as from that of treatment. Leukoplakia of the tongue or cheek is of syphilitic origin in the majority of cases in which it is seen. Its importance lies not alone in the fact that its presence when associated with atrophy of the tongue will frequently permit of a diagnosis of syphilis, but more particularly in that early recognition and adequate treatment may prevent malignant degeneration of the leukoplakia (Fig. 4). A statistical survey shows that leukoplakia among women is not so rare as was formerly thought.

The diagnosis of a syphilitic infiltration or ulceration known as a gumma of the tongue is not a simple procedure, because it is difficult to distinguish such lesions from tuberculosis and cancer. When syphilis is strongly suspected, a therapeutic test with arsphenamine and bismuth or mercury may produce immediate improvement, sufficient to call the treatment test-positive. If improvement is slow in appearing, a specimen should be removed for histopathologic study. On more than one occasion, I have encountered a case in which a gumma enveloped a cancer of the tongue and in which antisyphilitic treatment overcame the syphilitic infiltration, but did not, of course, influence the cancer.

Ulceration of the hard or soft palate from syphilis, with perforation of the palate, is classical and needs no description here. A properly fitting plate or denture often affords patients comfort in eating and facility in talking.

In the late forms of syphilis in which the nervous system is involved, particularly tabes dorsalis (locomotor ataxia), there is potential danger of fracturing the jaw when extracting a tooth. This is because, in the advanced cases of tabes dorsalis, the bone sense is lost and fracture following only slight trauma of any of the bones is not uncommon. In these cases, union of the fragments is most difficult, and if the fracture is in the proximity of a joint, a flail or Charcot joint may result in permanent nonunion.

There is a common misconception that any surgical procedure on a patient with syphilis is a hazardous undertaking. I believe this idea is unwarranted, and that surgical measures can be carried out in such cases with satisfactory end-results, if certain fundamental facts are borne in mind. In the case of the patient who has recently acquired syphilis, the danger of infection to the operator is the paramount consideration; whereas, in cases of latent syphilis, surgical intervention usually results in an uneventful recovery. The real hazard lies in the possibility of operating on a syphilitic lesion that has

previously been unrecognized. Occasions when this has been done, and they are not rare, usually lead to rapid recurrence and extension of the lesion. Some oral surgeons insist that a moderate course of treatment be given to such patients before and immediately after operation is performed, even though no clinical evidence of the disease is noted in the mouth. This procedure is commendable because it prevents the possibility of the operator's acquiring the infection and assures the patient that no untoward results will develop from his infection. This program is of no value for the patient with neurosyphilis, particularly of the locomotor ataxia type.

A syphilitic lesion of either the early or late form vanishes with great rapidity from the mucous membrane or skin after the administration of arsphenamine and bismuth or mercury. The response is decidedly slower if the underlying bony structure is involved, and it may be necessary in such cases to remove the sequestrum surgically, with the least possible trauma, before complete healing occurs.

Syphilis is not always a lethal disease, as in many cases it runs a mild course, responds readily to treatment and causes the patient slight if any inconvenience. On the other hand, it may be manifested from the onset as a virulent disease, pursue a rapid course and lead to the serious complications that are not only incapacitating but also fatal within a few years. There is no accurate means of determining at the beginning of the infection whether the course will be a mild or a malignant one; hence, it is obligatory that such patients with early syphilis undergo a complete and intensive course of treatment. Adequate treatment at this time not only does away with the likelihood of serious sequelae of the disease developing years later, but it also renders the condition noninfectious. It is therefore essential to the public health aspects of the disease and is also a means of preventing its further dissemination.

SUMMARY

Syphilis is of great significance to the dentist, from both a diagnostic and a therapeutic standpoint, and by its recognition the dentist may not only prevent a patient from suffering from unnecessary sequelae, but also protect himself and his assistants from the possibility of acquiring the infection.

The dentist should know that syphilis is highly infectious during the acute phase, that many of the lesions which are so highly infectious are to be found in the mouth and that the older the disease is in years, the smaller the possibility of its being infectious. He should also know that arsphenamine with bismuth or mercury render the disease noninfectious when these drugs are given adequately and intensively, and that the liberal use of soap and water on the hands, vigorously and immediately applied, is a most satisfactory means to prevent acquiring the disease extragenitally. In addition to thorough washing, instruments used on patients with syphilis should be boiled for ten minutes.

The ability to recognize the lesions of syphilis as they appear in the oral cavity is not dependent solely on a knowledge of the clinical characteristics, but is also greatly influenced by the examiner's threshold of suspicion, a suspicion based on the fact that syphilis is not a respecter of one's station in life.

SPRING LOCK AND INSERTION PIN LOCK ATTACHMENTS IN SADDLE DESIGNS FOR PARTIAL DENTURES*

By FERDINAND G. NEUROHR, D.D.S., New York City

UNFORTUNATELY little time and thought are given by members of the profession to the designing of saddles for partial dentures. This highly important work is only too often turned over, with instructions, to a commercial laboratory. The fact that the laboratory is primarily interested in getting the case out and finished, and that it generally knows little or nothing about the maintenance of health, and cares less, makes this exceedingly important link in our chain a very weak one, to say the least. In my opinion, it is the dentist's duty to design his own cases; for only in this way will he be able to render the thorough service to which his patients are entitled.

Although the selection and design of the attachments is a most important part of partial denture design, it is quite generally acknowledged that each type possesses some advantages that are lacking in others. The converse is also true; i.e., each type possesses some disadvantages that may be lacking in one or all of the others. It was in an attempt to eliminate the disadvantages and to combine as far as possible the advantages of all in one type of attachment that I designed the spring lock and insertion pin-lock attachments.[1] Since then, each of the claims made for these attachments has been substantiated. Results have exceeded the expectations of many dentists who have acquainted themselves with the use and the construction of these prostheses.

Although I am showing today the use of the spring lock and insertion attachments in my saddle designs, I wish to assure those who are unfamiliar with the spring lock and insertion type of work that the principle of saddle design which I am going to talk about will improve any case most materially, regardless of the type of attachment used. The type of attachment, though it may have a tremendous influence on the value of the case, alters these saddle designs very little, if at all.

There are several fundamental principles underlying proper designing of saddles, not the least of which is that the saddles should cover as large an area as possible. This fact has been so commonly accepted that it has become a law; but it does not offer the solution of the entire problem. It is of equal importance that cases be so designed that all force shall be equally distributed over this entire area in a direction and a form not detrimental to the supporting tissues. Regarding this important phase of this work, there remains some difference of

*Read before the Section on Partial Denture Prosthesis at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 6, 1935.

1. Neurohr, F. G.: D. Cosmos, 72:1299 (Dec.) 1930.

opinion. One writer or clinician will hold that rigidity is the property most desired, and he will give good reasons for his opinion. Another will maintain that movability and flexibility are the properties desired, and he also will present good reasons for his stand. It is in an effort to reconcile these apparently opposite points of view that we shall discuss the question in some detail.

Fig. 1.—Case constructed for woman thirteen years ago, the upper central and lateral incisors being restored by jacket crowns, the two cuspids with post crowns and the remainder, exclusive of the upper left second molar, with a partial denture.

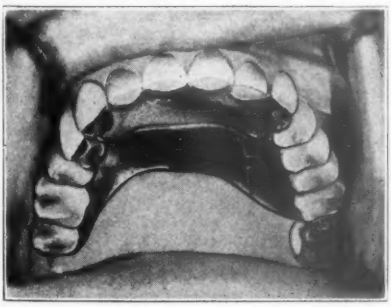


Fig. 2.—Detailed attachments and arrangement of case in place in mouth of patient referred to in Figure 1.

FLEXIBILITY AND RIGIDITY

Figures 1-2, present a case that I restored about thirteen years ago. The four upper anterior teeth had jacket crowns. The cuspids, which had been devitalized, were restored with post crowns, and incorporated with them were split bars for the retention of the appliance. It will be observed that the third molar is in place on the left side, but that all teeth posterior to the cuspid are missing on the right. It was therefore necessary to make the right side tissue-bearing, and the left side tooth-bearing, because of the absence of a posterior tooth on the right side. In order to meet these requirements, a cantilever

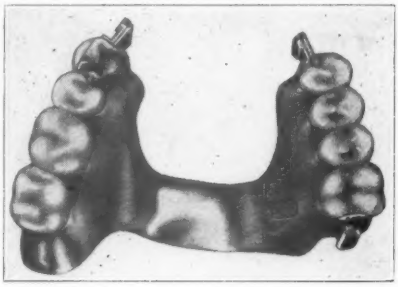


Fig. 3.—Upper denture with the two split bar attachments, Gollobin attachment on molar, watch hinge and stop on palatal bar and cantilever stress-breaker and set screw on right bicuspid. (Compare Figures 1-2.)

Fig. 4.—Case constructed for woman twelve years ago.

stress-breaker was placed in the first bicuspid pontic on the right side (Fig. 3) and, as I wished to be sure that the left side would not receive any tension from this movement, I placed a watch hinge in the palatal bar just left of the peak of the vault.

This case is commendable esthetically,

I believe, and at the time I was proud of the result. But the case was an utter failure. The patient was compelled to be out of town for several months, and when she came into the office again, all three abutment teeth were so loose that they could be removed with the fingers. Surely, plenty of flexibility had been allowed in this case. Had I, on the other hand, made this case entirely rigid, with abutments fastened firmly against the struts, providing no "give" of any kind, the drag on these abutments from such an appliance would have torn them down. With such construction, we are all familiar. Its detrimental effects, we quite generally understand, as the "give" of the saddle must involve injury to the remaining abutments. I believe that the flexibility present rendered the breaking-down process in this case much more rapid than had there been rigidity. So, when I hear that flexibility is desired, and again that rigidity is most necessary, I reply that I have found from experience that the question of flexibility and rigidity depends entirely on the case in hand. There are occasions when flex-

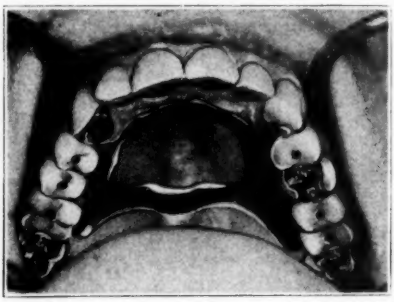


Fig. 5.—The partial denture in place in mouth, showing double bar and arrangement of frictional attachments. (Case referred to in Figure 4.)

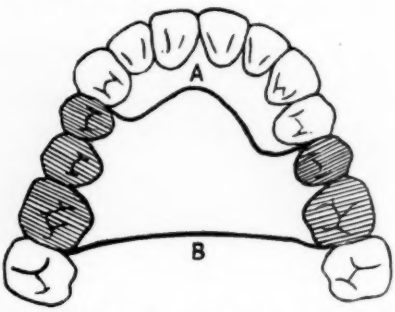


Fig. 6.—Primary step in method of design for partial dentures, showing tissue clearance, *A*, or anterior extremity of saddle, and posterior extremity of saddle, *B*.

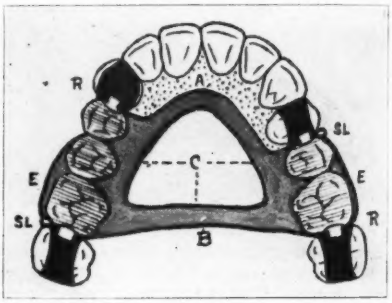


Fig. 7.—Simple tooth-bearing partial denture.

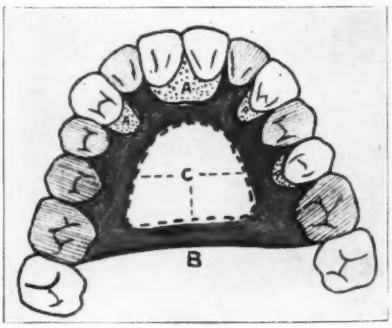


Fig. 8.—Preliminary steps in designing of complex tooth-bearing partial denture, showing tissue clearance, *A*, posterior of saddle, *B*, and central relief, *C*.

ibility is of paramount importance, and others when rigidity is the prime factor. If we have flexibility where we should have rigidity, and vice versa, failure is bound to ensue.

In this particular case, it was correct to allow flexibility of movement in order that the right side be tissue-bearing, but a grave mistake was made in allowing

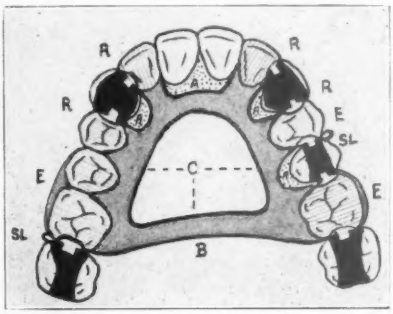


Fig. 9.—Finished design of complex tooth-bearing partial denture.

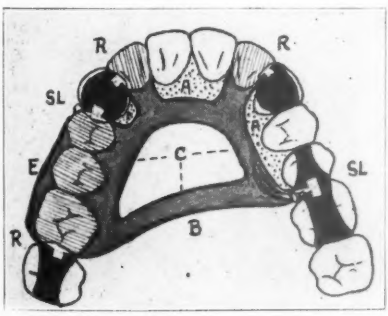


Fig. 10.—Method employed in designing tooth-bearing partial denture when all teeth on one side are present.

flexibility across the palate. As is so often necessary in order to have proper cusp relationship, these teeth were placed slightly buccally from the crest of the ridge. When masticatory pressure was brought to bear on these teeth, therefore, extreme buccal pressure was exerted on the abutments because of the flexibility of the hinge bar. Such a condition might also ensue if the teeth were placed upon the ridge, but buccal interference in the movements of the mandible cannot, for some reason, be entirely eliminated. We are dealing, remember, with

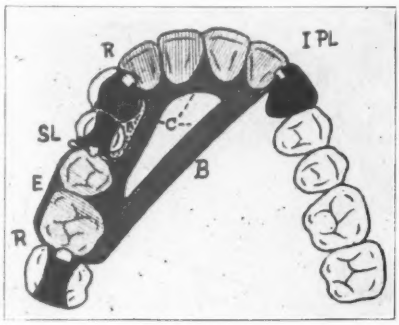


Fig. 11.—Design for partial denture when all of teeth on one side are present, but no isolated pontics are needed.

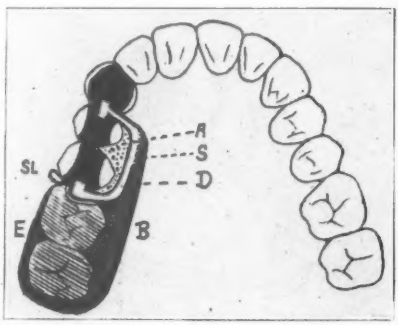


Fig. 12.—Simplest form of tissue-bearing appliance.

partial dentures and, in the construction of partial dentures, we have not the latitude in the placement of the teeth that we have in the construction of full dentures. There are places where extreme rigidity across the palate is of extreme

importance. With such rigidity, buccal movement of these teeth would be impossible, even though it would be necessary, because of the demands of occlusion and of esthetics, to place them slightly buccally from the crest of the ridge.

Although an effort was made to save these teeth by reducing the trauma, damage of such extent had taken place that it was almost a useless fight. The hinge joint of the bar was soldered closed, but, even so, it was found that considerable flexibility existed in this bar. The bar was strengthened by soldering wire over it, and it was only when there was an uncomfortable amount of bulk that it was possible to give this case sufficient rigidity to meet my purpose. Although the appliance remained in use five or six more years after this change, it was not comfortable, on account of the injury that it had

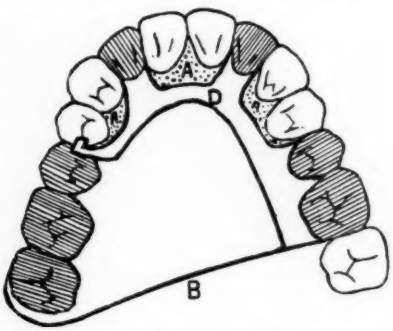


Fig. 13.—Preliminary steps in designing of complex tooth-and-tissue-bearing appliance. *A*, saddle clearance; *D*, tooth-bearing part of appliance, shown as one entity, and *B*, posterior extremity of the saddle.

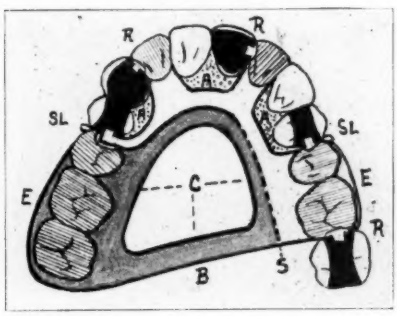


Figure 14.—Completed design for complex tooth-and-tissue-bearing partial denture.

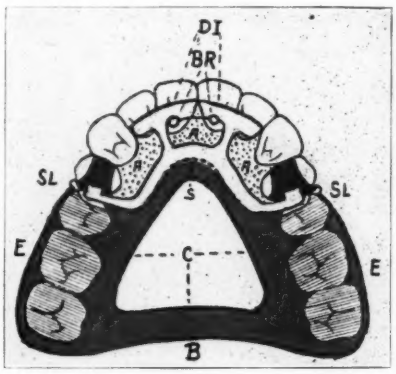


Fig. 15.—Completed design for complex tissue-bearing appliance when all anterior teeth are in place.

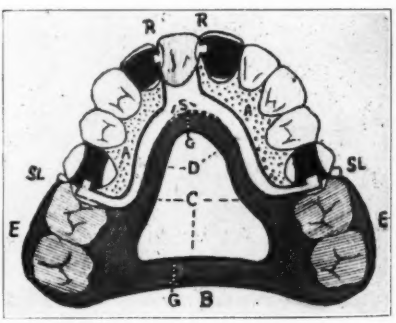


Fig. 16.—Finished design for complex-tooth-and-tissue-bearing appliance when no posterior teeth are present, but when one or more of anterior teeth must be supplied.

caused during its early stages, through faulty design and my ignorance.

Figures 4 and 5 show another case that was made about a year later. Because of the experience I had had, I made a change in the design, using a double bar. It was found that by using a double bar, the two bars were thrown into different planes, and maximum rigidity with minimum bulk was obtained. This was making use of a simple law of mechanics. We know that when a board that is placed over a span is set on edge, it will stand a great deal more weight than when it is lying flat. Of course, we cannot place bars exactly on edge as the builder does when we construct an upper case, as such a procedure would interfere too much with the comfort and function of the mouth; but we can place them in different planes and so retain much of the advantage and, at the same time, have them lying flat against the tissues. The anterior bar may be kept well away from the gingiva of the anterior teeth and still, because of the shape of the roof of the mouth, be in an entirely different plane from that of the posterior bar, which is nearer the posterior extremity of the hard palate. By this design, maximum rigidity with minimum bulk is obtain-

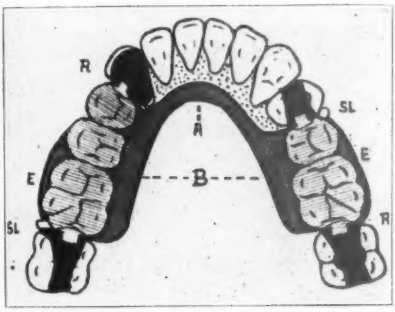


Fig. 17.—Methods used in designing similar cases for lower jaw.

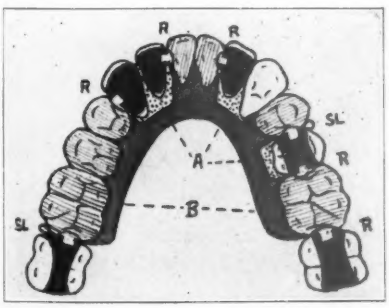


Fig. 18.—Methods used in designing similar cases for lower jaw.

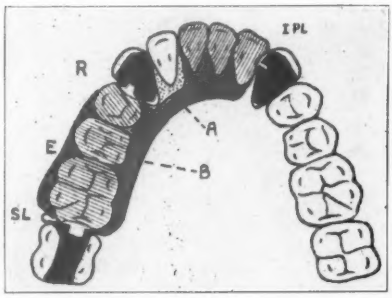


Fig. 19.—Methods used in designing similar cases for lower jaw.

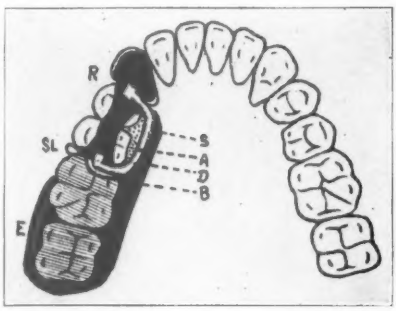


Fig. 20.—Methods used in designing similar cases for lower jaw.

able. As this appliance was entirely tooth-bearing, and as posterior teeth were present on both ends of the span, no stress-breakers were resorted to. This case was therefore constructed with this arrangement, and is still giving satisfactory service after twelve years.

With the necessity for this rigidity across the vault of the mouth in mind, together with the need of breaking the stress on the abutments where indicated, I formulated a principle that all of the tooth-bearing parts should be one entity, and all of the tissue-bearing parts another, these to be joined together, the remoteness of the soldered joint controlling the amount of flexibility or rigidity which this appliance should possess between these parts.

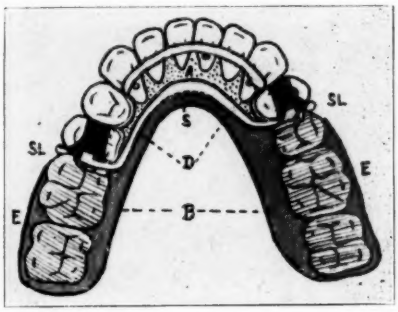


Fig. 21.—Methods used in designing similar cases for lower jaw.

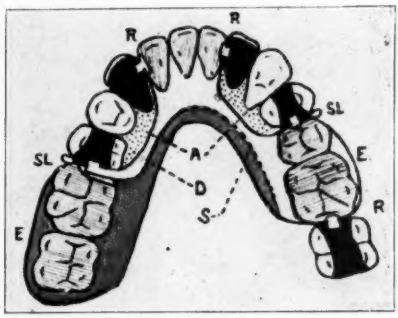


Fig. 22.—Methods used in designing similar cases for lower jaw.

TECHNIC OF SADDLE TRACING

When the tracings of these saddle designs are studied, they at first appear somewhat involved. Particularly is this true in the more complicated cases. If certain principles are kept in mind, we find that what appears to be a complex arrangement is rather a simple one. In an effort to understand the technic of this procedure, let us examine the tracings of the different types of designs that are characteristic and, in this way, enable

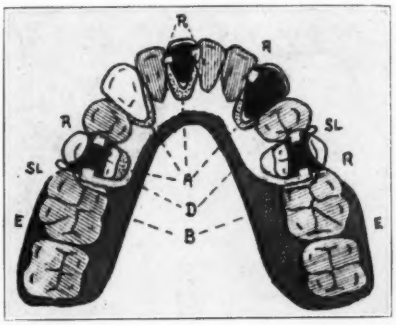


Fig. 23.—Methods used in designing similar cases for lower jaw.

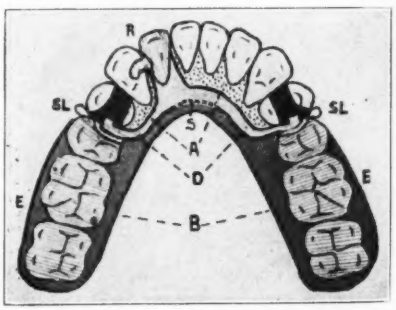


Fig. 24.—Methods used in designing similar cases for lower jaw.

ourselves to meet the numerous variations presented in actual practice.

The simplest form, of course, is that of the entirely tooth-bearing appliance (Figs. 6-7). Some may suggest that these missing teeth be restored with two unilateral bridges instead of a partial denture, a course that is often advantageous, but not always so. There are occasions when we wish, because of the weakening of the abutments, to place the least possible stress on the abutment teeth. Particularly is this true when the teeth must be set buccally from the ridge because of considerations of esthetics or when the bite is of such a nature that undue buccal stress cannot be entirely eliminated. A partial denture is indicated here, for, by the use of the opposite side as a stabilizer, and establishment of rigidity across the vault of the mouth, buccal stress on these teeth can be minimized.

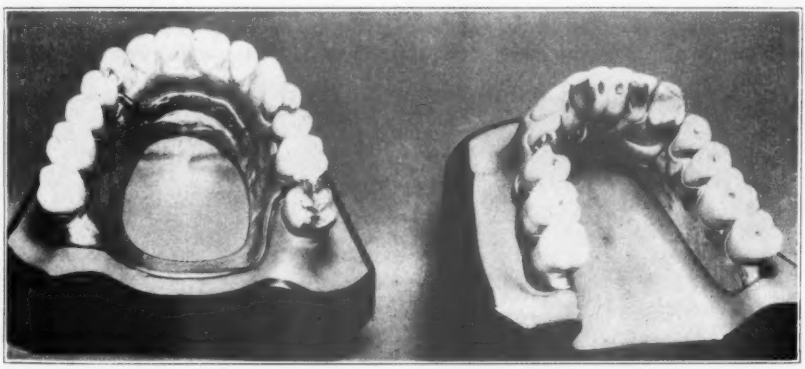


Fig. 25.—Upper and lower partial denture constructed upon principles outlined.

We are all familiar with the law of the lever. The closer the fulcrum is placed to the object to be moved, the more easily can the object be moved. Why not incorporate the law of the lever in the design of the partial denture? The fulcrum would be the crest of the ridge on the working side. The short arm of the lever would be the distance from this point to the point of contact with the opposing teeth. The latter would vary, of course, the degree depending on the extent of lateral excursion; but, in any event, this distance would be extremely short when compared with the distance between the crest of this side (the fulcrum) and the teeth on the balancing side. When we maintain this long arm with rigidity across the mouth, the balancing side will, with very slight strain, counteract even a tremendous force on the working side. This does not mean that the abutments should be rigidly attached to the denture: just the opposite is true. The attachments should allow movement of the teeth in order to minimize functional interference of the abutments, if we wish the best results.

We shall find that, as a general principle, if we trace around the remaining teeth, allowing sufficient space for the gingival tissues, and connecting the mesial surfaces of the posterior teeth on both sides, we shall automatically obtain a proper saddle design for our cases. Though there are other things to be

added in the more complicated cases, fundamentally this simple procedure holds true for all. In Figure 6, the only anterior teeth remaining are those from the right cuspid to the left bicuspid, so line *A* is drawn to mark the anterior border of the saddle. The two posterior ends are now drawn together with line *B*. It is generally advantageous to give this line a slight anterior inclination between the two posterior teeth. Such design is desirable because it will place the center of the vault of the bar inside a box formed by connecting the tooth-bearing rests or attachments of the appliance, and so will add materially to its stability. When inclined distally, the center of the bar will be outside this box, and will act as a lever, with a tendency to tilt the appliance when the tongue is pressed against it. Although this distal inclination is undesirable and should be avoided wherever possible, it is sometimes necessary in order to avoid a prominence or malformation of the hard palate.

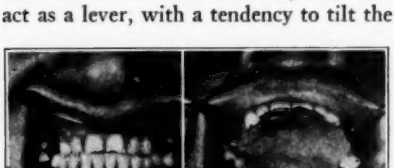


Fig. 26.—Practical case before treatment.

The design as now presented (Fig. 6) gave an appliance the entire palate of which was covered, except around the gingiva of the remaining teeth. If now a circular palatal opening (Fig. 7 *C*) is drawn, the saddles and bars are automatically formed. This simple procedure of marking the gingival clearance of the remaining anterior teeth, regardless of where they may be placed, and of connecting the mesial surfaces of the posterior abutments, will, with this circular line, give the proper saddle design. It is then an easy procedure to indicate by lines *E*, Figure 7, where we wish the gold saddle to cover the buccal portions of the ridge, and where, for esthetic reasons, we wish the teeth ground to the gum. On examining the cut again, we will note that, in this design, I have indicated that the upper right first bicuspid be ground to the gum. Of course, where stress-breakers and other things are included, other features must be added, but fundamentally the procedure is always the same.

On completion of this saddle design, the type and position of the abutments are sketched in. In a design of this type, it is not only unnecessary, but generally detrimental, to place clasps or attachments on all four of these abutments. Regardless of the type of attachment used, when two diagonally opposite corners are tied down, either by clasps or attachments, it is only necessary to place rests, though they must be definite, in the opposite diagonal corners. When a

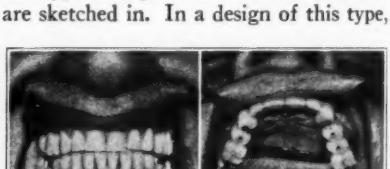


Fig. 27.—Case shown in Figure 26 after restorative work had been done, and occlusion balanced. Jacket crowns were placed on the upper central and lateral incisors. The two cuspids were restored with thimble jackets and the molars with gold castings, and the missing teeth replaced with a tooth-bearing partial denture, rigid in construction across the palate, and with spring lock attachments. The lower anterior teeth were restored by means of porcelain inlays.

box is placed on a table, and the diagonal corners of that box are held down, it is impossible to raise any of the four corners. It is for this reason that only two spring locks have been used to tie this case down, the bicuspid on the left side and the second molar on the right, but with definite rests in inlays in the other two abutment teeth. This composes the simple tooth-bearing partial denture with the maximum rigidity across the vault in proportion to its bulk.

Figures 8-9 show a more complex tooth-bearing bilateral design, made so by several small spans. Here again, it will be noted that the remaining teeth have been given gingival clearance (*A*). The mesial surfaces of the two posterior abutments have been joined together (*B*) and the circular center (*C*) automatically gives us the bar and saddles. Again, the buccal extension of the gold saddle is indicated (Fig. 9 *E*).

Figure 10 is a design of a case supplying the two lateral incisors, and the two bicuspids and the molar on the right side. Many would prefer to make two fixed bridges supplying the lateral incisors, and a bridge of some kind supplying the two bicuspids and the first molar. When the abutments are firm and the occlusion is of such nature that no overstress will take place, I have no fault to find with such a procedure. However, conditions arise wherein the making of fixed bridgework would be undesirable for this mouth, if not detrimental to it. Where there is a minimum load, a partial denture that will allow stability by the rigidity of the appliance across the vault is indicated, and where the sanitary condition of a removable appliance is necessary or desirable, a partial denture is indicated. Particularly is this so when, because of their looseness, there is a possibility of periodontal destruction of the abutments or other remaining teeth. With a partial denture of this type, it is possible to add them to such an appliance instead of being compelled to tear out bridges and make extensive new constructions. Again, it will be noted that this appliance is tied down to diagonal corners, with stable rests on two others.

Figure 11 shows a type of case commonly seen, where the four anterior teeth and two bicuspids or a bicuspid and molar, as in this case, have been lost. Again, a fixed bridge from cuspid to cuspid, with a small bridge supplying the bicuspid and molar, could be used; but when conditions make it more desirable to use a removable appliance, this may be accomplished by using an insertion pin in the left cuspid, rests in the right cuspid and right second molar and a spring lock in the first bicuspid. Clasps could be used, but they would not achieve esthetic values and stability so well, or protect the abutments from caries and trauma, as would the spring lock insertion system.

There is considerable confusion in the minds of many dentists as to where the field of bridgework stops and the field of the partial dentures begins. The most commonly accepted line of demarcation is based on the fact that a bridge is tooth-bearing and a partial denture tissue-bearing. Though saddles have been used in the cases in the preceding designs, these cases are all tooth-bearing, but surely they cannot be called bridges. On the other hand, Figure 12 shows an appliance that is mostly tissue-bearing in its function but still, in my opinion, cannot be classed as a partial denture, but rather must be regarded as a distal extension bridge. For this reason, I am of the opinion that unilateral appliances come under the heading of "bridgework," and that as soon as they are connected by palatal or lingual bars or cov-

erings, i.e., cross the arch, they come under the heading of "partial dentures," regardless of whether they are tooth-bearing or tissue-bearing, or a combination of the two. This brings us to that other fundamental rule, namely, that all of the entirely tooth-bearing parts of an appliance, including the rests, should be made as one entity, and the tissue-bearing parts as another. It is desirable to have these entities in as few parts as possible. The remoteness of the soldered joint connecting these entities will govern the amount of tissue-bearing properties such units will possess. This seems rather complicated, but it is in reality a simple procedure when certain principles of design are understood, and I believe is best to be explained by designing a case in each of the principal classifications.

The tissue-bearing and tooth-bearing appliance, of course, in its most simple form, is the unilateral distal extension bridge (Fig. 12).[2] This we will now consider, even though it differs slightly from partial dentures, using it as a means of introduction to the more complicated tooth-and-tissue-bearing bilateral cases. Again, clearance of the gingiva, *A*, is marked around the two bicuspids that are to be used as abutments, and by placing another line, *D* and *S*, under it and extending it to include the rests in the inlays, a tooth-bearing entity, that is to say, the two rests and a bar connecting them, is formed. The tissue-bearing saddle is now outlined so that it extends under this bar and the remoteness of the soldered joint (dotted line *S*) from the rest on the second bicuspid will control the amount of tissue-bearing property this saddle will possess.

Figures 13 and 14 show a more complicated partial denture where the two lateral incisors, the left second bicuspid and first molar are missing, and, on the right side, all teeth are missing posterior to the first bicuspid. Proper design would necessitate a tissue-bearing saddle on the right side, as no posterior tooth is present, while the two lateral incisors and the second bicuspid and first molar on the other side, because of the fact that they are small spans, should be taken care of by a tooth-bearing appliance. As is my general procedure, the lines *A*, Figure 13, clearing the gingiva around the remaining teeth, are drawn, and the posterior extremity of the saddle is indicated by line *B*. As all of the rests and the short spans are to be tooth-bearing, line *D*, taking in the rests and running as nearly as possible parallel to lines *A*, is extended to line *B*. This automatically forms our tooth-bearing entity. By extending line *B* (Fig. 14) to indicate the extension of gold saddle desired under the tissue-bearing entity, and by drawing a circular line *C*, automatically the bars and stress-breaker are formed, the extent of the soldered joint connecting the two entities by the dotted line *S* being indicated.

The case is now bisected in order to indicate the teeth that are to tie down the appliance, and, in this case, as two bicuspids divide the appliance almost in half, they are selected. The attachments are now indicated on these teeth. In this case, spring locks and inlays and rests are now drawn into the design for the support of the spans of the tooth-bearing entity. The cuspid has been chosen instead of the central incisor on the right side to support the lateral incisor, and the central incisor on the left side has been used for the same purpose, the extent of caries in these teeth determining the selection. As long as they receive a definite rest support, it matters little

2. Neurohr, F. G.: Spring Lock Dental Restoration and Distal Extension Bridge Designed upon This Principle, J.A.D.A., 20: 788 (May) 1933.

whether that support is on the distal surface of the tooth anterior to such a small span or on the mesial surface of the tooth posterior to such a span.

The designs in Figures 15 and 16 are carried out in a similar manner. Again, the gingival aspect of the remaining teeth is circled by lines *A* and the posterior saddles are circled by line *B*. The connection or formation of the tooth-bearing entity is formed by the line *D*, while the circular line *C* automatically forms the bars and saddles. Where the last three or more teeth are missing on both sides, as in Figure 15, it is generally desirable to get tooth-bearing support on the anterior portion of the appliance instead of allowing the weight of the appliance to hang on the two abutments. This stabilizes the case, as may be illustrated simply by placing a pencil on a table. If we hold down one end of the pencil, the other end is easily raised. If, on the other hand, we hold that pencil down away from the end, toward the center, we shall find that it is impossible to pick up either end. It is for this reason that the extension *DI*, which is a modification of the Kennedy bar, is added to the tooth-bearing entity, and the doweled inlays in the central incisors, *BR*, are indicated on the design in order to eliminate the anterior migration of these teeth which would otherwise ensue, because of the wedging of this bar when the appliance is under pressure upon the inclined planes of these anterior teeth.

Figure 16 shows a prosthesis designed in a similar manner, but because a central incisor is being supplied on the tooth-bearing entity, supported by two definite inlay rests in the central and lateral incisors, no bar against the lingual surfaces of the teeth is necessary, as the central incisor will answer the same purpose.

The designing of the lower cases varies only slightly from the upper, as will be seen in Figures 17 to 24, the corresponding cases on the lower teeth. It will be noted that here again the gingival reliefs, *A*, are around the remaining teeth; that where there is a combination of tooth-bearing and tissue-bearing parts, line *D* is drawn in order to complete this entity (Figs. 20 to 24), and that line *B*, connecting the two extremities of the saddles, must be brought forward in order to form the lingual bar design, which of course is necessary on the lower teeth on account of the space which the tongue occupies. These lingual bars need no reinforcements as do the anterior bars on the upper teeth, because the shape of the tissues allows us to place them at more or less right angles to the line of force, and, in that way, the maximum strength and rigidity are obtained from these bars when such rigidity is needed across the mouth. The choice of abutments and means of stabilization of the lower cases is based upon the principles that govern the upper. The breaking of stress on the abutment teeth where no posterior teeth are present is shown by soldering these two entities together, as signified by the dotted line *S*; but it must be borne in mind that if this joint is soldered too much, resiliency will be interfered with, and distortion may result under the stress of mastication. It is likewise with clasps. If the arms of the clasps are not long enough, they are liable to become distorted when they are put in place in the mouth. Sufficient length allowance permits making the bars of necessary bulk and strength, and, at the same time, allows enough length to give the resiliency needed for the saddles to "give" against the soft tissues when masticating pressure is applied and to go back to their original form when masticating pressure is released, thus in-

suring the rest periods so valuable to the maintenance of health.

Figure 25 shows both an upper and a lower partial denture constructed upon these principles. Figures 26-27 show a practical case before and after restorative work has been done.

The value of this type of construction is many fold. It minimizes trauma; allows functional movement of the teeth and protects them from wedging; allows wide latitude for additions to dentures in cases offering insufficient periodontal support, and gives the utmost protection to the health and welfare of the remaining teeth and all of the abutments. It has another advantage. In the case of recent extraction, it is generally customary to place a temporary denture until the natural resorption has taken place. Because these cases are designed by assembling the tooth-bearing and tissue-bearing entities, it is possible to eliminate the need of such temporary appliances, except where extensive extraction has been necessary. Let us consider for a moment the case shown in Figure 16. Suppose that, at the time this case was to be made, it was necessary to remove one of the upper molars. Instead of placing a temporary denture, we could make the permanent one immediately, and when the gum and process have receded under the appliance because of the extraction, it would be an easy matter to separate that part of the appliance which covers the absorbed area from the rest of the appliance. (Fig. 16, *G.*) As none of the rests or attachments would be interfered with, it would be easy to place the remainder of the appliance in the patient's mouth, take an impression with it in place, pour a model and, by utilizing the same teeth (which had already been ground) rewax this portion of the saddle to the new model, cast it and solder it to the appliance. By this procedure, the patient would have the advantage of having the final denture immediately, with less trouble to the dentist and less discomfort to himself, instead of being provided with a mediocre temporary appliance, as is usually done under other procedures.

It is a simple matter to make such additions because the rests and attachments are not disturbed. We all know that when it is necessary to disturb rests and attachments in an appliance, it is easier to make a new one. Unequal pressure, due to the slightest tilting or moving of the appliance during the impression taking, makes it almost impossible to replace rests or attachments in their exact positions. To make matters worse, we can never tell whether such displacements have taken place until the repair is finished and the appliance tested in the mouth. When two or more attachments have been changed, as generally happens with partial dentures when repairs are necessary, there is no definite way to determine the seat of the trouble. In other words, it is generally extremely difficult to tell which attachment is out of place or whether both are at fault. All this uncertainty results in a great waste of time, and the "fussing" and trying out of the appliance by the operator is the best means of making the patient lose faith in the appliance before he has the opportunity of using it.

CONCLUSION

Partial dentures built upon the designs described can be made to minimize trauma, allow functional movement of the teeth, protect the teeth from wedging, allow wide latitude for additions and facilitate rebasing, making it possible to minimize the need of temporary appliances.

Probably the most decided advantage of all in the maintenance of health

which this design makes possible is the even distribution of pressure over both the hard and the soft tissues of the mouth during the process of mastication, and the absolute lack of any pressure on both the hard and the soft tissues during the periods of rest when the masticating force is released. Such periods of rest are essential to the health of these tissues, which will not tolerate a sustained pressure, no matter how slight. This even distribution of stress and release during the process of mastication also strengthens these tissues by increasing the circulation, and thus protects them from the rapid resorption often seen under partial dentures.

A CONSIDERATION OF HEART DISEASE AND SYNCOPE IN THE PRACTICE OF DENTISTRY*

By JOSEPH A. CAPPS, M.D., Chicago, Ill.

MANY occasions arise in the practice of dentistry when the dentist should give thought to the general condition of the patient, especially to the state of the heart and circulation. Can the patient safely take a general anesthetic? Is procaine anesthesia liable to produce untoward symptoms? Can prolonged treatments, such as the preparation and filling of cavities, be undertaken? What shall be done in case of loss of consciousness?

It may be assumed that the experienced dentist or oral surgeon will, before any major operation requiring a general anesthetic, consult the family physician regarding any possible serious defects of the cardiovascular system. Therefore, we may exclude from this discussion any further consideration of operations performed under general anesthetics.

My discussion will be limited to the rôle that heart disease or circulatory disturbances may play in the ordinary day's work of the dentist in his office.

*Read before the Section on Medical Relations at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 18, 1936.

HEART DISEASE

One of the most common forms of heart trouble is valvular disease, or endocarditis. A valvular murmur is readily detected with the stethoscope and traditionally is looked on as a serious lesion of the heart. Actually, unless the inflammation is recent or active, a mitral regurgitation or stenosis involves little risk in dental work. The state of the myocardium is what determines the competence or lack of competence of the heart, and to determine this factor of heart muscle integrity is the first thought of the physician.

How does one determine whether the heart muscle is reasonably competent? The most reliable criterion is not the stethoscope or the electrocardiogram. The most final of all tests is the patient's response to exercise. If he walks and climbs stairs without dyspnea, his heart muscle is probably competent.

IRREGULARITIES OF THE HEART

Some of the forms of arrhythmia of the heart are of little consequence; others are important. The ordinary occasional skipped beat, or extrasystole, frequently

encountered, especially in late adult life, is negligible. It may be easily recognized by the observation that any quickening of the pulse obliterates the irregularity.

When the pulse becomes more irregular, as the rate increases from effort or excitement, the arrhythmia may be the so-called fibrillation of the heart. Such a condition calls for great care in avoiding prolonged fatiguing work. If one finds the pulse extremely slow, say 30 to 50, as in heart block, the physician should be consulted before an extraction or the use of a local anesthetic.

In angina pectoris, the heart pain is produced by any act or condition that heightens the blood pressure, such as exercise, excitement or pain. An extraction or painful drilling might easily cause an attack, with bad results. All patients complaining of heart pain on effort should be referred to the physician and the proposed procedure should be discussed with him. In many instances, of course, it is necessary to incur a certain amount of risk. Occasionally, the pain of angina is referred to the jaw or teeth. This often leads to unnecessary extraction of a tooth. The pain is transmitted along the trigeminal nerve and is induced by exercise.

Of all the varieties of heart disease, angina pectoris is the one that is most likely to precipitate a scare or even a tragedy in the operator's chair. Nearly every experienced dentist can tell of anginal attacks that have interrupted his routine work and endangered the patient's life. It is well to bear in mind that cocaine accelerates the heart rate and increases the blood pressure—the exact conditions that favor the attack of angina.

Intravenous administration of epinephrine, of course, greatly increases the blood pressure, but it has little influence on the pressure when injection is made under the skin. When injection is made into the mucous membrane, with its rich blood supply, there is a definite rise in blood pressure. The use of epinephrine with procaine is said to be an advantage as it constricts the blood vessels and so arrests the local circulation that the procaine is absorbed slowly; which thereby minimizes the stimulating effect on the blood pressure. If one seeks to avoid a rise in blood pressure, he will act wisely to use procaine alone and dispense with the epinephrine.

It is safer to use procraine anesthesia than none at all, because severe pain itself is a most potent cause of elevation of blood pressure. Glyceryl trinitrate (nitroglycerin) or amyl nitrite ampules should always be at hand in the office to be administered for an attack of pain.

FAINTING, OR SYNCOPE

Loss of consciousness may be the symptom of serious organic disease; e.g., cerebral hemorrhage, uremia, fibrillation of the heart or coronary thrombosis. In the vast majority of such accidents, the fainting spell has no such origin. It is of great practical importance that the cause and mechanism of these attacks be understood.

The physiologic explanation of syncope is a loss of consciousness from an inadequate flow of blood to the brain. This occasionally occurs from failure of the heart. Ordinarily, it is the consequence of faulty distribution of blood by the vascular system. A fall in blood pressure is characteristic of syncope. When the systolic blood pressure falls below 60, there is nearly always loss of consciousness and the pulse becomes weak and difficult to palpate.

EFFECT OF POSTURE

We often see light-headedness or faintness from sudden change of posture, especially in elderly people. If a rabbit

is held up by the ears for some time, it will lose consciousness. Similarly, when a person rises suddenly from a recumbent position, there is a momentary drop in blood pressure and perhaps a slight lightness of the head. In certain people, this phenomenon is more marked, and fainting may ensue. After a long period of rest in bed, even a normal young person may faint on suddenly rising and trying to walk. Certain adults feel faint on stooping to tee up a golf ball. A sudden shift in the circulation of the blood that deprives the brain of its normal supply explains these symptoms.

VASOVAGAL ATTACKS

The commonest form of syncope has been termed by Sir Thomas Lewis as vasovagal attacks. Such attacks are often seen in young people and have various causes; e.g., the sight of blood, sitting in a hot badly ventilated room and fatigue, especially during the menstrual period and during convalescence from infections. Moderate pain, as has been stated, tends to heighten the blood pressure, but extreme prolonged pain, such as is encountered in coronary thrombosis, gallstone colic or a difficult protracted tooth extraction, may induce a fall in pressure followed by syncope.

These attacks always occur when a person is in the upright position. With loss of consciousness, he falls to the floor, and thus the cerebral circulation is restored. In these vasovagal attacks of syncope, which comprise the great majority of fainting spells, the following observations can be made: (1) a fall in blood pressure to 60 (systolic) or lower and (2) a slowing of the pulse.

The fall in pressure is attributed to a sudden vasodilatation that drains the blood into the great vascular beds of the abdomen. The slowing of the pulse is due to an overaction of the vagus nerve on the heart.

These two mechanisms may work together or singly. As was stated, a fall in systolic pressure much below 60 results in fainting. The pulse may slow down to 40 without loss of consciousness, but at 20 or 30 beats a minute, even with normal pressure, the cerebral supply of blood is inadequate and faintness develops.

When the two conditions work together, e.g., fall in blood pressure and slowing of the pulse, the ischemic effect on the brain, i.e., that due to a deficiency of blood, is heightened.

Although these vasovagal attacks are often precipitated by cerebral emotions, such as fear and fright, it is interesting to know that, in the body, there are several locations or centers from which unconsciousness may arise through a somewhat similar mechanism.

For example, pressure on the carotid sinus in certain persons will bring about slowing of the pulse and a fall in blood pressure sufficient to induce fainting. Also, stimulation of the inflamed pleura during thoracentesis (surgical puncture of the chest wall) may set up identical symptoms. Sudden stretching of the anal sphincter sometimes produces syncope, probably of similar nature.

Vasovagal syncope, of course, may develop in cardiac patients, but, even in them, the heart is seldom to be held accountable.

With this discussion of causes of syncope, let me specify what should be done by the dentist who encounters this symptom:

If a patient faints, let the operating chair down to a horizontal position. As a rule, this will restore the circulation in a short time. Pressure by the hands on the abdomen helps to force the blood out of the splanchnic vessels. A hypodermic

injection of caffeine sodiobenzoate, 3 to 4 grains, is also useful. Smelling salts are perhaps the most accessible and efficient remedy.

Do not be overly concerned if the attack lasts four or five minutes.

For an attack of angina pectoris during operative procedures, lower the head and let the patient inhale a crushed ampule of amyl nitrite or drop glyceryl trinitrate solution on the tongue.

Rarely will the dentist experience a major accident such as an attack of coronary thrombosis or cerebral hemorrhage, although such an accident may occur in spite of all precautions.

A CLEAR INSTANCE OF REPAIR OF A FRACTURED ROOT: REPORT OF CASE

By ESTHER E. SVOBODA, D.D.S. and F. J. SVOBODA, D.D.S., Cozad, Neb.

A WOMAN, aged 21 and in good health, gave a history of a fall on the ice at the age of 12 while skating, a central incisor being broken so that the crown hung loose, apparently being held only by gum tissue. The patient pushed the tooth back in place and said nothing to her parents. In about six months, she went to a dentist for other work, and this central incisor was found to be firm but discolored. It remained comfortable till the patient came in again, in August, 1935.

The tooth was quite discolored and it was assumed that the pulp was dead. The patient had been told some time previously that the tooth would have to be extracted to protect her against possible infection from it. Her request to have the tooth extracted seemed so reasonable that it was removed with the expectation that the crown would come away, leaving the root to be removed later. But crown, root and all came away intact, and it was then found that, while the line where the tooth had been fractured showed clearly, there was apparently perfect union between the two parts. The tooth was sectioned labiolingually through crown and root, and the two halves indicated the line of fracture across the entire tooth, but with undoubted union. Across the labial aspect mesiodistally, there is a slight groove, which shows in the roentgen-ray film herewith presented.

View of fractured tooth showing slight groove across labial aspect mesiodistally.

Otherwise, the two parts are held together perfectly.

When the tooth was severed longitudinally with the thin stone, the pulp canal was encountered, and the dried remains of the pulp still fill the canal, which shows that the pulp was undoubtedly alive when the tooth was extracted.

The Journal of the American Dental Association

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor

Published by the American Dental Association

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $5.00 a year in advance, this rate applying to both domestic and foreign subscribers. All foreign subscriptions are to be paid in United States money.

Editorials

AN ARRAIGNMENT OF MOTHERS

If ever there was a sacred individual in the entire human race, it is the mother of a child. This has long been so generally acknowledged that no one ever thinks of questioning it. Then why the caption of this editorial?

In all equity, it probably should have been modified to read: "An arraignment of some mothers, and for doing certain things." A mother, with all of her manifold virtues, does not invariably display the best judgment when it comes to the management of her children. Her natural instincts of sympathy and lack of self-control sometimes impel her to do things that are the very reverse of beneficial, either to herself or to her child.

Too frequently, she, in common with every other adult, will regale the child with tales of the most grotesque extravagance when it comes to dealing with the ailments that are prone to attack childhood. Why is it that a loving mother will permit her child to be fed up on stories of the horrors of the dental chair when

she knows in her heart that, in the ordinary course of events, that same child must come to the dentist sooner or later?

Every dentist has at times been presented with the problem of a terrified little child looking up from the chair with tears streaming down his face in anticipation of the terrible things that were supposedly about to happen in that chair. And when the dentist, in an effort to soothe the child and quiet the tempest of fear and grief, seeks to minimize the spectacle of pain by a few kind and assuring words, it is rather disconcerting to have the child look up and sobbingly exclaim, "But mother said—."

Some of the things that mothers say under these circumstances are not calculated to make the situation less tense or difficult, and while we sympathize with the problems that necessarily arise in the rearing of children, we must question some of the methods that are used by devoted mothers in attempting to cope with the emergencies that develop when illness of any nature attacks the child.

A recent case is typical. The root of a deciduous tooth had not properly absorbed, and the tooth remained firm, so it had to be extracted to prevent an irregularity. A lusty howl was immediately set up by a very dear little girl, and when the assurance was given that something would be put on the gum to make it free from pain, back came the rejoinder through some very copious tears: "But mother said that you had to stick a needle in the gum before you could numb it."

The consideration, ingenuity and intuition of a loving mother can often be relied on to meet a difficult situation more acceptably than any other agency known to man; but all mothers do not possess intuition or judgment, and when lacking in these attributes, they are often the most unfortunate of all individuals to turn loose on a timid defenseless child.

Usually, it is the part of wisdom for mothers to remain out of the operating room during work on the child that is likely to entail any difficulty. At least, a mother should be spared the tension and anxiety of witnessing what often seems to her a trying ordeal to the child. The daily demands on the energy and nervous force of the mother in meeting all of the problems incident

to the rearing of children take a toll that should never be ignored, and the mother should be spared in every way that she legitimately can.

More than any other human being, a mother should seek to absolve herself and her child from the incubus of fear and needless apprehension. Fear is the greatest handicap of humanity, and the greatest menace to our peace of mind.

What, then, shall we say of the one most perfect and most essential of all individuals in the entire human race when she permits herself, through lack of vision or a perversion of judgment, to sanction and even to encourage those practices which she must know in her heart of hearts are inimical to the welfare of her child and, in the end, to her own peace of mind?

In conclusion, we are inclined to modify our title. It is not so much an arraignment as it is a plea; a plea to all of the dear mothers of the land to cultivate the kind of judgment that shall insure for their children not only good health but also the greatest stability of character. In accomplishing this, we must at once recognize the uncomfortable fact that we are not always permitted to proceed along the lines of least resistance. In the maintenance of rugged health and mental stamina, we frequently encounter the most strenuous resistance—resistance that must be bravely met and stoutly maintained. In no other way shall we come into the kingdom, either for the mother or for the child.

THE GOVERNMENT AND THE CITIZEN

Injustice invariably brings about resentment against the object that causes the injustice. This is illustrated concretely and vividly in the changing attitude of the citizen toward the Government.

Time was when Government commanded a very wholesome respect on the part of the citizen. The citizen exhibited a certain amount of deference, and even of awe toward the constituted authority known as Government. He willingly and even eagerly took off his hat to the flag of his country. Even if he did not analyze the precise process through which his mind traveled in

lifting his hat from his head, there was implied in the act an inner consciousness that was wholesome. There was a tacit acknowledgment on the part of the individual that, after all, there was some authority that transcended the authority inherent in the individual. On the abstract principle that the whole is greater than the part, Government stood for something that commanded respect by the citizen.

To an almost appalling extent, this is all changing, and there is a growing tendency to flout the Government and even to sneer at governmental authority. The reason for this change is found directly in the fact that Government has instituted unjust procedures and imposition on the citizen. Government has become so oppressive that the citizen is beginning to chafe under the restraint. An attitude of resentment toward the Government on the part of the citizen that at one time would have been accounted grotesque and almost dangerous has become so common that it seems an actual necessity if a grievous wrong is to be righted.

History is filled with illustrations wherein an oppressive government has attempted to take its citizens by the throat and compel them to submit to abuses, but ultimately the usual result has been an uprising on the part of the citizens and the overthrow of the government. In almost every community of men, there can be found the nucleus of a superb manhood that will not sink its soul and submit to unjust oppression.

Were it not for this, we would have dictators—more of them than we have—and dictators invariably drift into an assumption of power that very soon becomes unwholesome. No one man has ever assumed the rôle of a dictator and maintained it indefinitely. Sooner or later, it is found that the people are more powerful than a potentate, and the balance of power changes from the individual to the community.

Wise is the dictator who discovers the limitations of his power in time to curb his ambition, and yield to the better impulses of equity and justice. In no other way can he escape disaster; but some dictators never seem to learn this lesson.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Guttapercha and Cajeput—Touch warm guttapercha on way to cavity with oil of cajeput.—*C. C. Norris, Oshkosh, Wis.*

Perfume—A drop of perfume on the cotton in the air compressor will scent the whole room.—*C. C. Norris, Oshkosh, Wis.*

Applicators—Strip off the barbs of old broaches with a pair of pliers, form a small loop in the end and use them for medical applicators.—*H. M. Flickinger, Siloam Springs, Ark.*

Care in Administrating Local Anesthetics—Only a heavy-gage needle should be used for mandibular injections. Care must be taken that the syringe does not leak.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Sharpening Burs—Half of the cutting end of cross-cut fissure square cylinder burs is usually the only part that gets dull. If the dull end is broken off with a pair of pliers, the burs will give double service.—*H. M. Flickinger, Siloam Springs, Ark.*

Patience—A great deal may be gained by listening attentively to the patient's story. Instances can be called to mind by any practitioner of obtaining valuable information by letting the patient tell his own story.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Cavity Lining in Silicates—One should apply cavity lining to each cavity prepared for synthetic porcelain. A small round straight bur, or a bur for the straight handpiece, is dipped into the cavity lining and applied to the prepared cavity and dried. The silicate restoration is then completed.—*Ralph E. Gieringer, Cincinnati, Ohio.*

Sterilizer in Action—I believe the sterilizer should be so located that the patient sees it in action. It is best to leave it on the low heat for the entire day. Less current will be used than when it is turned on high for even a third of the time. When a cloud of steam rolls out at any time the cover is lifted, the patient can see that it is always in use.—*Henry Stevens, Hart, Mich.*

Sinusitis Not of Dental Origin—When there are no infected teeth nor deep pyorrhea pockets surrounding the teeth lying in close proximity to the antrum, the source of antrum infection is to be found elsewhere. It may be in the frontal, sphe-

noidal or ethmoidal sinuses, and the dental practitioner should not treat these types of antrum infection, for the condition will invariably recur.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Oral Cysts—Cysts are frequently encountered in dental practice and, unless they are very large, the general practitioner can usually cope with them without difficulty. The technic of their surgical removal consists either in complete enucleation of the cystic sack or in removal of the outer wall, the cystic cavity being thus converted into an accessory cavity of the mouth, which, in course of time, becomes filled in and hence obliterated.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Golden Rule—An idea so often expressed by the late Chalmer Lyons, of the University of Michigan, one of the grand old men of oral surgery in America, may profitably be repeated. It was essentially this: "Never criticize the work of another man while in the presence of the patient. You do not know the conditions under which he worked. You may not have done any better yourself." If every dentist were to observe this rule, it would be better for the profession as a whole, and I am sure, far better for the two members concerned.—*Henry Stevens, Hart, Mich.*

Phenomenon of Decay—Did you ever stop to think how strange the destruction of teeth is, and how their loss is accomplished? There are just two main channels of destruction; one adds, the other subtracts. During the loss of the teeth by the deposition of calculus, there are deposits being progressively added to the shaft of the tooth. The process of decay is just the opposite, in that there is tissue being progressively taken away from the tooth structure. Is not this a curious phenomenon of addition and subtraction?—*Calvin William Knowles, 177 Post Street, San Francisco, Calif.*

Nature Vs. Human Skill—Patients often become prejudiced against dentistry because the dentist fails to accomplish what nature could not or did not do. Disappointments are the result of expecting too much and getting too little. It is not possible for the dentist to do the impossible and the dismissal of patients should carry the assurance of the dentist's responsibility only to a reasonable degree. When one does inferior work because of the patient's financial status, in fairness to the dentist an explanation should be made. If given a chance, nature would do far more for the teeth and dental efforts would be far more satisfactory.—*Herbert Ely Williams, Red Bank, N. J.*

Dentures After Six Months' Wear—After six months' wear, dentures do not restore sufficiently unless all of the restorative factors have been overdone on insertion. Lips and cheeks appearing too full become adapted and level off to their new environment. Slight excess in length of bite is corrected with the condensing and resorption of the tissues. The patient's fear of overprominence must not mislead the dentist. If dentures restore today and fail to restore six months hence, they are temporary only. A mouth overplump is much better than one sunken and wrinkled, showing approaching age. The earmarks and crow's feet of advancing years come fast enough without the assistance of restorations which do not restore.—*Herbert Ely Williams, Red Bank, N. J.*

COUNCIL ON DENTAL THERAPEUTICS

ANNUAL MEETING OF THE COUNCIL ON DENTAL THERAPEUTICS*

It is an established principle of the Council on Dental Therapeutics to advise the members of the dental profession and the public of its decisions as soon as circumstances permit. In accordance with this established principle, the following items discussed during the last meeting of the Council, which may be of interest to both dentists and manufacturers, are authorized for publication.

SAMUEL M. GORDON, *Secretary.*

ARTICLES ON PHARMACOLOGY AND THERAPEUTICS

Since its inception, the Council has published articles on general or debatable topics in therapeutics related to dentistry. These articles are intended to evaluate information on general classes of drugs or therapeutic procedures of interest to dentistry. It is the intention to continue the preparation of these articles. Some of the articles that have appeared since the last meeting of the Council are: "Sodium Perborate: Limitations of Its Use"; "Topical Anesthetics with Reference to Saligenin"; "Calcium and Phosphorous Compounds in Dentistry"; "Practical Value and Limitations of Topical Anesthesia in Oral Surgery," and "Shotgun Vitamin Therapy."

VITAMIN C

The attention of the Council was called to the promotion of vitamin C "Roche" (Hoffmann-LaRoche, Inc., Nutley, N. J.) in the field of dentistry. It is advertised to both dentists and physicians as the antitoxic vitamin for sound teeth and sturdy bones and for use in treatment of hemovascular diseases, hay fever and other allergic conditions and dysfunction and malnutrition. Dentists and physicians are invited to write for details of a test to be used in diagnosing prescorbutic states.

The advertising states:

> The determination of C avitaminosis or deficiency by means of this test may point to the pathogenesis and indicate the proper therapy in cases of hitherto obscure etiology. Included in this category are: Faulty metabolism and growth, lowered resistance to infection, toxic states following acute infections, such as acute exanthemata, upper and lower respiratory tract infections, rheumatic fever, alimentary infections, genito-urinary infections, arthritis, cachectic states, hemo-vascular disorders, arteriosclerosis, capillary fragility, peripheral vascular disease, anemias, purpura, thrombocytopenia, hemophilia, allergic conditions, hay fever, eczema, psoriasis, intestinal upsets, intestinal dysfunctions, enteritis, colitis, coeliac disease, faulty bone and tooth development, gingivitis, dental caries, pyorrhea, non-specific gingivitis.

This product has not been accepted by the Council on Pharmacy and Chemistry. Such claims go beyond those permitted in New and Nonofficial Remedies and are not to be found in advertising for a brand of cevitamic acid (crystalline vitamin C, introduced as ascorbic acid) listed therein. Under actions and uses for cevitamic acid, the following restrained statements appear in New and Nonofficial Remedies:

*Continued from p. 1369, July issue.

Cevitamic acid is indicated for prophylaxis and treatment of scurvy. Its use in caries and in other conditions in which a deficiency of vitamin C may be a contributing factor is not established.

The Council is in accord with this statement. It appears, therefore, that the promotion in the above mentioned manner is premature and that the claims are unwarranted and exaggerated.

No clinical evidence is available that faulty tooth development in the human being is inhibited by the use of crystalline vitamin C, or that gingivitis, dental caries, pyorrhea or nonspecific gingivitis is prevented or corrected by the administration of this product.

The Council does not deny that deficiencies of vitamin C may lead to abnormal or pathologic conditions of the gums or teeth, but the evidence presently available does not permit outright statements as to its usefulness for the dental conditions enumerated above. Hence, until more adequate evidence, clinical or otherwise, is available, the Council urges dentists to guard against the indiscriminate use of this drug as suggested by Hoffmann-LaRoche. Premature advertising and uncritical use may militate against its usefulness, if and when its place in dental therapeutics is properly evaluated. The problem of the exact place of crystalline vitamin C in dental practice is worthy of further study by critical methods and by critical investigators.

For those dentists desiring to experiment clinically with the use of crystalline vitamin C under controlled conditions, there is available Cebione-Merck, an accepted form of the drug listed in New and Nonofficial Remedies, which is advertised with claims that have been submitted to, and found acceptable by, the Council on Pharmacy and Chemistry. It is also worthwhile to note that this firm has communicated with the Council regarding advertising to the dental profession. Restrained promotion of new products deserves the commendation and support of the dental profession.

The type of propaganda indulged in by Hoffmann-LaRoche should be frowned on by dentists and physicians. It is beyond understanding when a house of the standing of Hoffmann-LaRoche, which has had extensive experience with the requirements of the Council on Pharmacy and Chemistry, indulges in such an unwarranted form of advertising. Dentists are already acquainted with the fact that while several of the products of Hoffmann-LaRoche are listed in New and Nonofficial Remedies, none is listed in Accepted Dental Remedies, and that, unfortunately, this house has advertised several products to the dental profession prematurely.

DENTURE CLEANERS AND ADHERENT POWDER FOR DENTURES

Chapters on denture cleaners and adherent powder for dentures appear in Accepted Dental Remedies, 1935. The information has been reviewed. Neither chapter appears to need extensive revision at the present time. The Council discussed the advisability of discontinuing acceptance of products of this class and decided no longer to accept preparations of these classes and to omit the currently accepted products at the expiration of the present term of acceptance.

The Council suggests that dentists acquaint themselves with the full composition of such products as they may suggest for their patients' use. Some of these may contain undesirable substances. The burden of proof of the composition should rest upon the manufacturer and not on the dentist or his patient.

ADVERTISING, EXHIBITS AND THE COUNCIL

The fact must again be emphasized that if there were no advertising problem, bodies like the Council on Dental Therapeutics might not have been called into existence. With only a few notable exceptions, the most prominent of which is THE JOURNAL, advertising in many dental journals is of such a character as to reflect on the scientific and professional standing of dentistry. Hence, the character of advertising in dental journals and

exhibits at national and state dental meetings occupies a very important place in the scheme of proper drug control. Much of the information that becomes the subject of discussion among dentists may come through advertising of proprietary drug products. The Council regrets to note that some dental journals have not yet taken steps to raise the character of their advertising to the same plane as that now occupied by THE JOURNAL.

It has noted the advertising of an out-and-out nostrum that was seized for violation of the Food and Drugs Act, while the advertising was appearing in a proprietary magazine. It was also the subject of a report holding it not acceptable by the Council, and subsequently the company was debarred from the use of the mails because of the fraudulent character of the scheme. (P.T.M.—Not Acceptable for A.D.R., *J.A.D.A.,* 22:1395 [Aug.] 1935; 23:693 [April] 1936.) No doubt, excuses may be offered in explanation of the acceptance of this advertising, but the advertisement was already *fait accompli.* It illustrates one of the results of not following the same policy as that adopted by THE JOURNAL; that is, of accepting no product for advertising unless it has been accepted by the Council. Incidentally, a review of the advertising in that proprietary journal indicates that many products that are not worthy of the dentist's attention and some of which are outright nostrums are being advertised to dentists, undoubtedly in the hope of their recommendation to patients by the dentist. It is not uncommon knowledge in the drug trade that one of the most effective ways of advertising to the public is not to advertise directly to them, but to build up a market through advertising in dental and medical journals whose standards are below those of the organized groups in dentistry and medicine, which speak for all dentists and physicians.

The Council has therefore appointed a committee whose services are available through the office of the Council to pass on advertising which may be submitted to dental journals. The Council extends an invitation to editors of journals published for dentists to avail themselves of the facilities of the Council.

ACIDS IN ROOT-CANAL THERAPY

Acids are used in root-canal therapy for enlarging root canals that supposedly cannot be made accessible by simple mechanical means. The views on the rationality or desirability of this procedure vary among root-canal therapeutists. Some subscribe to their use provided they are used carefully, while others are outrightly opposed to the use of acids in root-canal therapy.

Some of the objections offered to its use are that not enough calcareous material is dissolved to materially alter the canal, and that there is danger of forcing acid through the canal and giving rise to pericementitis of chemical origin. The information in A.D.R. attempts to reflect this division of opinion. For example, A.D.R. 1935, page 23, points out:

> Hydrochloric acid is used for chemically enlarging root canals. It should be followed by a neutralizing agent. As in the case of other acids used for this purpose, extreme care should be taken against forcing some through the apex. Its use for this purpose is not generally condoned, some root canal therapeutists holding that enlargement of the canals should be carried out by mechanical means.

HARTMAN'S SOLUTION

During the latter part of 1935, reports appeared in the public press concerning the discovery of a preparation that would, it was said, enable the dentist to perform many dental operations with complete freedom from pain. Such an accomplishment, if fully realized, would be monumental. This was an announcement of great importance to the dental profession and the public. The nature of the preparation, said to have been uncovered by LeRoy L. Hartman, professor of operative dentistry, Columbia University, College of Dental and Oral Surgery, was not available until January, 1936. At that time, an address on "A New and Effective Means For Dentin Desensitization" was presented before the First District Dental Society. According to this report, the so-called Hartman's

solution was a solution of thymol in alcohol and ether, the proportions of which were declared. No proprietary rights were declared for the product and it thus assumed the status of a nonproprietary article. Dr. Hartman announced a technic that should be followed in using the preparation. From a reading of the report, no special contraindications to the use of the preparation appeared, and success was, it seemed, to be expected from the application of the solution as directed.

After the lecture, items appeared in newspapers throughout the country. This led to a number of inquiries concerning the product from dentists. While exact information from sources independent of Dr. Hartman's clinic are not yet available, it appears that Dr. Hartman's results cannot be confirmed by many operators.

Several dental societies and dental school clinics are undertaking tests of the product to evaluate its clinical usefulness. The profession can well afford to await the outcome of these experiments. The Council considered the advisability of having an independent investigation conducted under its auspices, but it was believed that such an investigation could be delayed until the results of the investigations in the several dental societies and dental school clinics were published.

A review of the literature with respect to the active ingredient, thymol, was carried out. John Tomes, in the second edition of "Dental Surgery," published in 1873, mentioned the use of thymol among other agents for reduction of sensibility of dentin in the course of dental operations.

The use of thymol to reduce dentin sensation apparently was common on the Continent during the latter years of the nineteenth century. H. Christian Greve wrote *(Heilmittellehre fur Zahnarzt,* 1898, pp. 223-224): "For the relief of sensitive dentin, a crystal of thymol is placed in the cavity and melted with warm air. Thymol dissolved in oil of cloves or eugenol may be used as a pain relieving application in pulpitis partialis acuta."

Similar observations were recorded by Guido Fischer (Die Lokale Anasthesia, *Zahnhielkunde,* 1911, page 27), Karl-Ludwig Koneffke (*Rezeptierbuch fur Zahnarzte,* 1922, p. 78) and Carroll W. Allen (Local and Regional Anesthesia, second edition, 1918, p. 645).

Thus, the use of thymol, alone or in solution, has long been known to dentists. The proponents of the new solution unfortunately have not provided enough clinical evidence that a solution in alcohol and ether is more efficacious than melted thymol alone.

The action of thymol and other agents in pulpitis has been studied experimentally by the Japanese investigators, Yao and Nagira. (*Folia Pharmacol. Jap.,* 12:6, 1931.) They found that, in pulpitis, thymol, cinnamon oil and wintergreen oil may be useful. In experiments carried out on rabbits' teeth, in which they drilled holes and electrically stimulated the pulps, the strongest depressant was creosote and, after that, thymol. Wintergreen oil and cinnamon oil acted weakly, and alcohol, not at all. While the conditions in these experiments are not strictly comparable with those of Hartman's tests, these tests are susceptible of objective control with a satisfactory criterion of anesthetic efficiency, which is difficult to secure in the case of patients because pain is a subjective phenomenon.

The Council concluded, in the light of the information available, that there appears to be no originality in the use of thymol as an agent for desensitizing dentin. The evidence available for the usefulness of the product does not support the enthusiastic claims advanced for it by its sponsors. The Council has therefore deferred further consideration of this formula for admission to A.D.R. until more acceptable evidence is available.

The Council desires to point out that the name, Hartman's solution, is unfortunate. A more appropriate designation would be: solution of thymol in alcohol and ether. A solution advocated for use in transfusion in general surgery is referred to as Hartman's solution. This Hartman's solution is a sodium bicarbonate-lactic acid buffered solution. Confusion in the medical and dental literature can be avoided by a more informing designation as suggested above.

More information is desirable concerning the effect of using thymol in close proximity to the pulp. In the past, thymol has been one of the medicaments that have been used as mummifying agents. This would suggest a possible deleterious effect when the agent is in contact with pulp material.

LOCAL ANESTHETIC SOLUTIONS

Before the formation of the Council, dentists were, as a rule, in the dark regarding the exact composition of the solution they were injecting for the production of local anesthesia. The semisecrecy that appeared to be the usual commercial practice at that time led to the bewilderment of the dentist. Aside from the technical aspects, the dentist was placed at a disadvantage if, through some incident wholly unrelated to the operation for which the anesthetic was injected, the outcome was unfavorable and he was made the defendant in a law suit. His defense would be made more difficult if he were forced to confess an inadequate knowledge of the composition of the injected solution.

Furthermore, many dentists were bewildered by the claims and counterclaims made for competing products as to the presence of a preservative. Again, the dentist was placed at a disadvantage in attempting to correlate the effect of the salts dissolved in the article for purposes such as "isotonicity," "buffering action" and action as an "anti-oxidant," with the efficiency of anesthesia. These circumstances were apparent to the Council. The progress toward improving these conditions made by several manufacturers who have submitted their products to the Council should be gratifying to dentists.

Much improvement in these conditions comes as a result of attention to exact labeling of these products. In the case of a local anesthetic containing, for example, procaine and epinephrine, the Council has required, as one condition of acceptance, a full statement of composition, including the preservative and other subsidiary ingredients, on the principal label of the package. This was based on the view that a declaration of the amounts of procaine and epinephrine were not sufficient and might be misleading to the dentist, since the usual claims made in the promotion of this class of material were for or against the ingredients other than procaine or epinephrine, since the use of these agents had become quite standardized in practice.

This is an application of the decision of the Department of Agriculture with respect to the Food and Drugs Act of 1906, which had lain dormant for years. Apparently, because of the Council's activities in this connection, this was publicized by the Administration in a notice to manufacturers, which said in part:

> The formula on the label is very desirable, but this information is not required by the law. . . . If the formula is given it must be the correct and complete formula. It is held that, in addition to those substances required by the Act to be named, if only a part of the active medicinal agents used in the manufacture of a drug product are set forth on the label, such a procedure is misleading and therefore forbidden by the law.

In commenting on this decision, the Food and Drug Administration said:

> It has come to the attention of the Food and Drug Administration that certain manufacturers are disclosing on their labels portions of the formulas in such a manner as to create the impression that the complete composition is given. For example, ampules and cartridges containing solutions of local anesthetics are labeled to show the quantities of the anesthetic, the vasoconstrictor and the solvent, if other than pure water. These articles often contain, in addition, compounds to preserve or stabilize the solution, a fact which is not disclosed on the label. Such a method of labeling is misleading in that it appears to disclose the whole formula and may readily deceive the physician or dentist.

This is an example of how organized dentistry can give support to the officers charged with the enforcement of the Food and Drugs Act. Thus, it is apparent how the work of the Council on Dental Therapeutics, carried on quietly, in the course of a few years, has influenced the administration officials to take action designed to further protect the patient and the dentist. It should be apparent at once to dentists that the rules and the requirements of the Council for this class of products go beyond those provided for by

the present legal method, for Rule 1 of the Council points out that no product can be admitted to A.D.R. unless a full statement of composition is given.

STANDARDIZATION OF PROCAINE AND EPINEPHRINE PRODUCTS

Examinations of several proprietary preparations of procaine and epinephrine were carried out from time to time in the A.D.A. Bureau of Chemistry for the content of procaine hydrochloride. Some of these solutions contained as much as 2.25 gm. of procaine hydrochloride per hundred cubic centimeters, or 112 per cent of the stated amount, as against 2 per cent. Others contained equally lower amounts. Until recently, there has been no exact definition of the limitations of 2 per cent. The Contact Committee of the American Drug Manufacturers Association and the Food and Drug Administration have prescribed, in the case of ampules of procaine hydrochloride, a variation of not more than 5 per cent either way, from the amount stated on the label, and 7.5 per cent either way, from the amount stated on the label, for hypodermic tablets of procaine hydrochloride when examined by an appropriate method.

The new edition of the National Formulary defines solution of procaine hydrochloride as containing in each hundred cubic centimeters not less than 1.9 gm. and not more than 2.1 gm. of procaine hydrochloride; that is, a 5 per cent variation in either direction.

One may gather from the remarks made under the labeling of this class of products that these are not necessarily official products, although they may contain ingredients that are listed in the official compendia. They may be listed in an entirely uninformative way and yet not conflict with the Food and Drugs Act. The Council therefore proposes to be guided by the standards set by these bodies in consideration of solutions containing procaine hydrochloride, and sold for local anesthetic purposes. Beginning June 1, 1936, the Council will be guided by such variations.

In the submission of this class of products, the Council will require that:

1. The products be labeled "Procaine solution" or "Procaine hydrochloride solution with epinephrine 1: . . . ."
2. A complete statement, in terms of grams (or milligrams) per cubic centimeter be given of all the ingredients on the principal label.
3. Evidence be submitted that the product is tested for sterility before release.
4. Information concerning the isotonicity be submitted if statements concerning this property are made.
5. Information concerning the hemolytic effects be given if claims are made in that direction.
6. Information that the product contains the amount of active ingredients declared on the label is made available before the product is offered for sale.
7. Assays concerning the stated epinephrine content be submitted.
8. Information concerning the amount of solution in each cartridge and its variation from an average value be submitted.
9. Suitable advertising be submitted.

The following is a suggested form of appropriate labeling:

BRAND
Procaine Hydrochloride Solution (2%) with Epinephrine
1: . . .
or
Procaine Solution (2%) with Epinephrine 1: . . .
Each cubic centimeter contains

Procaine hydrochloride (U.S.P.)	0.020000 gm. or	20.000 mg.
Epinephrine, 1:30,000	0.000033 gm. or	0.033 mg.
Disodium phosphate	0.003000 gm. or	3.000 mg.
Sodium bisulphite	0.001500 gm. or	1.500 mg.
Sodium chloride	0.002650 gm. or	2.650 mg.

In distilled water

The composition for various solutions need not be the same. The foregoing is a specimen of labeling that meets the requirements of the Council. In printing a label, emphasis should be placed on the active ingredients rather than on the container in which the solution is enclosed.

Thus, the dentist who limits his administration of local anesthetics to those products accepted by the Council can be reasonably certain that the amount of active ingredients will agree with the declared amount on the label, and not vary widely from the declared amount.

THE TERM "BUFFERED" IN CONNECTION WITH LOCAL ANESTHETICS

The term "buffered" in connection with local anesthesia was introduced into dentistry by Germans and into this country by a manufacturer of local anesthetic solutions. The claims based on this factor are, at the present time, greatly restricted in comparison with what they were originally. Most of the so-called buffered solutions on the market commonly contain, among other substances, disodium phosphate, and/or sodium bicarbonate as the buffering agents. While the claims, as mentioned above, are greatly restricted, some of the products are still labeled and advertised as buffered local anesthetics. The Council has reviewed the available evidence and has concluded that the evidence is not yet sufficiently satisfactory to warrant emphasis on this factor in the sale of such products.

This is not meant to imply that the use of highly acid solutions is to be encouraged. The Council agrees, on the basis of common information, that those solutions which approach the normal tissues in terms of p_H may be preferable, but no one has as yet sufficiently defined the exact buffering range at which the most effective local anesthesia is obtainable. No one has demonstrated a definite or important difference in solutions having a p_H, for example, of 5.5, 6.5, 7 or 7.2. The Council, therefore, cannot acquiesce in any claims made for the buffering action of local anesthetic solutions until more convincing evidence is available.

ACETANILID MIXTURES

Recently, the makers of Bromo Seltzer have been advertising, in certain dental journals, the harmlessness of acetanilid, an ingredient of Bromo Seltzer. No reference to Bromo Seltzer is made in these advertisements, but the advertisements are prepared in the interest of acetanilid, U.S.P., by the Emerson Drug Company, manufacturers of Bromo Seltzer.

Inquiries have come to the Council concerning the truthfulness of the statement as to the absence of deleterious action from the indiscriminate use of acetanilid and bromides. A member of the Council is reviewing the available evidence.

A preliminary report was presented to the Council, and because of the dangers involved in indiscriminate medication with acetanilid and bromides, the Council places on record, as a guide to dentists, the following: In view of the questionable character of the evidence upon which many of the claims for harmlessness are based, and of the possible health hazards resulting from the indiscriminate use of such mixtures, the Council desires to warn dentists against the indiscriminate use of acetanilid alone or in mixtures with other active drugs, including patented or proprietary products, until more satisfactory evidence of its harmlessness is available. A preliminary study by the referee has indicated that the recent experimental reports quoted in support of its harmlessness are misleading or questionable, since the use of proper animals and proper criteria for the study of chronic intoxication does not appear to have been adopted. At an appropriate time, a fuller report will appear in the Council's columns.

KELP

A communication was received from a health officer concerning the activities of the

Kelp Company of Zeeland, Mich., in connection with a product labeled Kelp. A representative of that company is attempting to place it, in tablet form, in the schools. It is claimed to be a preventive of dental caries, arthritis, and, in fact, many other ills.

Several years ago, the kelp product of this firm was submitted to THE JOURNAL. The status of the product with the Council was ascertained. Attention was directed by the promoters of this brand of kelp to reports by Melvin Page of Muskegon, Mich. These have appeared in THE JOURNAL. (Conservation of the Edentulous Process, *J.A.D.A.*, 22:52 [Jan.] 1935; Necessity for Endocrine Treatment in Successful Prosthesis, *J.A.D.A.*, 23:439 [March] 1936.) A member of the Council reviewed the first of these papers and concluded that there is no evidence to warrant the claims made for the product. THE JOURNAL was advised that the advertising would not be acceptable.

Kelp, under various trade names, has been advertised for the treatment of practically every disease to which human flesh is heir. A report of the Council on Kelpodine (*J.A.D.A.*, 22:316 [Feb.] 1935), another kelp product, brought out that many generalities concerning the relationship of iodine to the thyroid gland and to its part in well-being were indulged in. A study of American medical and chemical literature made in connection with the consideration of kelp shows that little has appeared to warrant the use of kelp in medicine, either alone or as a food supplement, although that kelp is a source of iodine has been known to chemists for a long time. Kelp has been advertised to the public and advocated to the dental profession as a sort of cure-all, not as a food or a drug, but as a supplement, whatever that may mean. The only purpose for which kelp may possibly have some usefulness is as a source of iodine. Even admitting its possible value as a source of iodine, there is no evidence available that kelp is superior to inorganic iodides, which have been used in the prophylaxis of goiter in endemic areas. Regardless of the molecular condition of iodine in kelp, the iodine will have to be converted into sodium iodide before absorption. Kelp represents an expensive source of iodine of unproven value. There is, of course, a real danger in indiscriminate medication with iodine-containing products in the case of those suffering with thyroid disorders. One of the main actions of iodine is to stimulate metabolism, after being converted to thyroxine. If we disregard the possible effect on those with overactive thyroids, it is only fair to state that preparations derived from kelp are generally harmless. Those who exploit kelp have the advantage over other quackish promoters in that the raw material can be had for the hauling. Chopping up kelp and selling it as such or compressed into tablets at an exorbitant price must be profitable to the promoter, with no proven advantages to the user.

Numerous violations of the Food and Drugs Act by promoters of kelp appear. More space than is available would be required to list the diseases and conditions for which kelp is recommended, but the following agreement of a respondent with the Federal Trade Commission is of interest: A seller of dehydrated kelp in tablet form for medicinal use agreed to stop advertising that it will "keep the human body well, or supply it with an adequate mineral reserve, or that kelp products are naturally rich in calcium, phosphorus, copper and iron, or otherwise exaggerating the mineral content of kelp." The respondent further agreed to cease representing that his brand of kelp "is not a drug: that it contains an adequate supply of food-iodine and all the organic mineral elements necessary to keep the body healthy and free from disease. . . ." The respondent stipulated that he will not represent for his brand of kelp that "many leading physicians believe that 95 per cent of all human ills arise from a lack of proper mineralization in foods, or that kelp is a specific, or has any therapeutic value in treating anemia, rheumatism, underweight, acidosis and other ailments, or that it is safe for use in cases of thyroid deficiency.

The claims made for kelp are so preposterous that they are beyond the range of scientific consideration.

DENTIFRICES

In the discussion on dentifrices, in which the present situation was reviewed, the Council noted:

1. The violation of the spirit, if not the letter, of the Food and Drugs Act by most advertisers of nationally advertised dentifrices. Little improvement could be expected in the advertising of this class of products, with due respect to their limitations, until more stringent food and drug legislation than is available at the present time is enacted.

2. Much of the advertising of this class of products has probably escaped investigation by the Federal Trade Commission because the character of competition in the whole field was such that the Commission could not take action since the Commission might have difficulty in proving unfair trade practices.

3. The Council's consideration of dentifrices on the grounds that they can be expected to do nothing more than aid in the cleaning of the surfaces of the teeth is responsible for slow but sure improvement in the field. It has tended to make dentists and the public conscious of the misleading character of the national advertising for this class of products.

4. The number of inquiries on dentifrices that come to the Council from students in high schools, junior colleges and universities, and a growing consumer reaction against this type of advertising, presents to the Association, through the Council, an opportunity to present honest and unbiased information concerning the composition and claims for these products.

5. The Council also considered the abuse of dentists in advertising these products.

The following general review of the dentifrice situation is presented:

The Council undertook the consideration of dentifrices at the instance of the dental members of the Council, whose position, in turn, was based on the desire of the profession for unbiased information. When the Council first considered them, dentifrices were marketed principally with emphasis on the claimed preventive and curative phases. Not one of the nationally advertised dentifrices was peculiar in being free of objectionable claims. The less prominent followed the pattern set by the more widely advertised ones. Evidence in support of the then current claims was as wholly lacking as evidence for many of the present claims. The profession realized that all a tooth paste could be expected to do was to aid the toothbrush in cleaning the teeth. The realization of this position undoubtedly was delayed by acquiescence in outrageously false claims by many dental journals as evidenced by acceptance of copy that carried all of these evils into the dental office.

No attempt, it appears, has ever been made to analyze the course of a dentifrice when used with a toothbrush. A dentifrice may be considered to touch the gums and the teeth. No evidence has been secured that dentifrices, either frankly medicated or unmedicated, were useful in preventing or overcoming dental diseases of either the soft or the hard tissues. Massage with or without the toothbrush is held by many conservative periodontists to be a form of preventive or curative therapy in certain diseases of the gum by virtue of the stimulation that it affords primarily to congested capillaries near the gingival margins. Periodontists, as a rule, are outspoken in their condemnation of any claims for dentifrices that assume to do more than the brush alone properly used could do. The function of a dentifrice, then, is best expressed in terms of the Council's statement: "An aid to the toothbrush in cleaning the surfaces of the teeth." Neither toothbrushes nor dentifrices, as they are commonly used, have been shown to clean between the teeth, or to clean effectively the lingual aspects, and there are some teeth which can be made "clean" only by careful instrumentation notwithstanding all claims to the contrary.

While there is no evidence available, it may be presumed, on the ground of general experience, that some dentifrices are better than others for cleaning purposes and some may be harmful because of a mechanical abrasive action. The latter was brought out by W. D. Miller almost three decades ago. ("Experiments and Observations on the Wast-

ing of Tooth Tissue Variously Designated as Erosion, Abrasion, Chemical Abrasion, Denudation, Etc." *Dental Cosmos,* January, February and March, 1907.) It is not uncommon to see cases of mechanical abrasion presumably due to the use of abrasive dentifrices, or to be informed of the presence of material in certain dentifrices which is capable of producing scratches on glass.

The willingness to consider and accept this class of products was predicated on divorcing the subject from the wishful thinking of advertisers and placing it, as nearly as possible, on scientifically objective and analyzable grounds. Another purpose of the Council's consideration of these products was to furnish a guide beyond which representations would be considered dishonest.

When, in 1931, the Council adopted its position on dentifrices, and admitted some of them to Accepted Dental Remedies, no attempt was made to secure from manufacturers close definitions of mechanical properties of these products. The more pressing problem was a moderation of the palpably false and fraudulent claims, and to acquaint dentists with the fact that their handing out so-called clinical samples was, in effect, making them the unwitting agents of advertising nostrums to the public for self-medication of gum disease. For example, the following is taken from a circular enclosed with a small "clinical" tube of Ipana Tooth Paste:

Start now to build healthy gums

Although this sample will last longer than others of its size, it would hardly be fair to assume that in a few days with a sample tube you can overcome a gum condition that has been years in developing.

Therefore, if your gums are soft or tender, if your tooth brush ever "shows pink," go to the drug store today and buy your first full-size tube of Ipana. If yours is an average case, you will note a distinct improvement after the use of one full-size tube—an improvement that, with reasonable care, should become permanent. . . . It is the presence of Ziratol that gives Ipana its remarkable power to help the health of the gums.

Incidentally, some dental journals, now as before, appear to be reluctant to dispense with the advertising of Ipana Tooth Paste because it brings in a few dollars. This refusal to accept the full responsibility implied in the Supreme Court's decision of the Oregon Case, that dentists are a professional group, and so are subject to different rules from those governing the merchant in the street, has no doubt given much aid and encouragement to certain manufacturers to flout the spirit, if not the letter, of the Food and Drugs Act.

The following constructive steps have been taken since the first consideration of these products:

1. The Council has consistently refused to accept dentifrices advertised for daily use which have silica or any silicious material as an ingredient.

2. The Council has discouraged, in the interest of public safety, the marketing and use of those dentifrices that contain potentially harmful substances such as phenols, perborates and metallic astringents. This policy is being followed with greater stringency than formerly.

3. The Council has secured the cooperation of certain manufacturers of basic materials such as chalk and calcium phosphate, for the purpose of defining more clearly the physical properties of insoluble dentifrice materials.

4. The Council now requires that manufacturers of dentifrices now submitted to the Council, and manufacturers whose products have been previously listed, submit statements as to the abrasiveness both of the insoluble material, if such a material is used, and of the finished dentifrice.

5. The Council has pointed out, for the benefit of the profession, the "patent" medicine character of many of the widely advertised dentifrices. In passing, it is strange that while many dentifrices are advertised as therapeutic agents, certain dental societies still admit these products to their exhibits.

The fact that much of the business of nationally advertised dentifrices is dominated by untruthful advertising does not, in any sense, vitiate the soundness of the profession's position as expressed by the Council. This position aims to substitute fact for wishful and dishonest thinking.

A little reflection will convince dentists that some manufacturers of dentifrices themselves find little of merit in their products, so that they must invent false, tricky or even fraudulent claims to keep up the advertising pace set years ago when dental science had not reached its present level. Unfortunately, for dentists and patients alike, honest advertising for most of the nationally advertised dentifrices is not yet to be expected because of the low plane on which the competition in the whole national field rests. Many of these products are, as a rule, sold in such a way as to violate the spirit, if not the letter, of the Food and Drugs Act of 1906. The false and fraudulent claims are made in mediums (magazines, radio and newspapers) that are not subject to the Act.

The question has often been raised as to why the Council does not file a complaint with the Federal Trade Commission. The advertising in such mediums may be subject to action by the Federal Trade Commission, but the Council has not filed a complaint with this body since it holds that the dental profession is not in competition with these purveyors of falsehoods.

It is common knowledge that the Federal Trade Commission finds it necessary to spend considerable time and public money in proving competition in order to make out a case against a product, even though the injurious effect on the public of the practices sought to be stopped is perfectly obvious. In the Marmola (an obesity cure) case, the Federal Trade Commission was overruled. The Supreme Court of the land held that the promoters of Marmola were not in competition with the medical profession. No matter how vicious or harmful to the public may be the practices sought to be stopped, if all the competitors of a respondent named in a commission proceedings are likewise using deceptive or vicious practices, the Commission may be challenged. A circuit court of appeals has held in one case that it is not incumbent on the Government to protect one competitor from others if all are engaged in the same character of harmful and vicious practices, notwithstanding the injurious effect of such practices on the public. It has been suggested that the Federal Trade Commission Act be amended so that the Commission would have the power to put a stop to practices that are against the public interest, whether engaged in by one or many persons, or by all in the industry.

As intimated above, the general practices of the larger dentifrice advertisers are on such a low plane that the Federal Trade Commission would have a difficult time in proving that a competitor had been injured by these practices, since the vicious practices were in accord with the usual standards of the trade. Furthermore, the Council does not desire to make a complaint, since its purposes are educational, not punitive.

The Council has already had enough experience with certain manufacturers of nationally advertised dentifrices to appreciate the little public responsibility assumed by the advertisers of these products. Heads of two of the largest dentifrice advertisers were active in attempts to weaken desirable food and drug legislation.

It was also pointed out above that the Council had not required, until recently, a close definition of the mechanical properties of the dentifrice, but this is now one of the requirements, and it thus places the consideration of dentifrices on a more positive basis. Fulfilment of this objective is being delayed until an independent study can be conducted in the Council's laboratory.

Dentifrices can be standardized on the basis of their abrasiveness. In the communication between a committee of the Federal Specification Board and the Council, a trend in this direction is indicated, but this, of necessity, calls for a standard measurement of abrasiveness and standardization of terms and practices. The Council has already assented to the proposition that a conference be held with manufacturers of insoluble

materials and of dentifrices in an effort to determine a standard of practice. It is hoped such a conference will be held in the future.

ABUSE OF DENTISTS IN ADVERTISING

Since its inception, the Council has been cognizant of the use made of phrases such as "see your dentist every six months," "do as your dentist does," "your dentist will tell you," "your dentist suggests," "dentists advise," to mention only a few, as the backbone of much dentifrice advertising. When appeals to beauty and social position, economy and the so-called scientific, and the other old bromides of tooth paste advertising, which is among the worst in the advertisers' field, failed, the dentist was rung in to complete the sales talk. Not one of the advertisers using such phrases had the slightest authority from any dentist or reputable dental society to give voice to their expressions. These expressions seem to be merely copy writers' delusions.

Squibb Dental Cream: "When thousands of dentists agree that ONE type of dentifrice is the most effective. . . ."

Listerine Tooth Paste: "Dentists warn against gritty dentifrices. If you're using one to fight tobacco stain, stop at once and try this safe, modern way."

Kolynos Dental Cream: "2054 Dentists in Chicago Approve of Kolynos Dental Cream. And after all, who knows better than your dentist what is best for your teeth. . ."

Pebeco Tooth Paste: "A prominent dentist was speaking: 'Yes, PEBECO Tooth Paste actually does the things that so many tooth pastes merely claim to do.' "

Pepsodent Tooth Paste: "Dentists urge you to employ the special dentifrice known as Pepsodent."

Ipana Tooth Paste: "Many dentists say: 'Clean your teeth with Ipana. . . .' "

Bost Tooth Paste: "Your Dentist will tell you tobacco stain precedes decay."

Colgate's Ribbon Dental Cream: "So she went to her dentist." "Bob, too, went to his dentist." "And then he saw his dentist." "So he went to the dentist." "She overheard her dentist say. . . ."

Dr. Lyon's Tooth Powder: "Try your Dentist's Way of tooth cleaning. . . ." "Do as your dentist does. . . ."

Phillips' Dental Magnesia: "Your dentist knows. . . ."

Printer's Ink (April 26, 1934, page 7) relates the story of the efforts of the Watkins' Company, owners of Dr. Lyon's Tooth Powder, to popularize tooth powders. This firm spent $4,210,000 in seven years in an intensive campaign to persuade their readers and listeners that dentists use powder and to make "Do as your dentist does" a byword. Dentists do not use powders in cleaning the teeth. Pumice or other polishing substances are first made into a paste with water or glycerine or other mediums before application. This is merely another example of the old trick of that part of the "patent" medicine industry represented by most of the national dentifrice advertisers. It cannot be denied that tooth paste represents a convenient form of tooth cleaning agents. As to the efficiency of one tooth paste over the other, this remains to be proved. This company is silent on the disclosure that, in 1927, reliable investigation showed Dr. Lyon's Tooth Powder to be one of the most abrasive on the American market. Whether they have eliminated this objection is not known. Thus, the attempt to saddle responsibility on the profession for the objections to the product may be an answer. But, unfortunately, their competitors are on no higher plane. For instance, the Colgate company discovers "bad breath" and attempts to make millions believe the dental profession advocates Colgate's tooth paste for it.

Competitor's goods are disparaged in order to increase the hawker's own sales. At the time the campaign for Dr. Lyon's tooth powder was started (and incidentally Dr. Lyon is not known to have had standing with the profession), tooth powders were few, and hence they could afford to disparage tooth pastes. But now those who were equally vehement in their advertising concerning tooth powder put out both paste and powder.

Is it not high time that the Federal Communications Commission and the Federal Trade Commission put a stop to this abuse of a profession whose agents have not been

consulted? If those people insist on making use of the dentist's position of authority on dental matters, they at least should show their authority for doing so. The only group speaking for dentists in this country is the American Dental Association, and the group within the Association that speaks on dentifrices is the Council on Dental Therapeutics.

A cleaning up of dentifrice advertising over the radio and in the magazines is long overdue. The Federal Communications Commission should not be concerned solely with the legal forms; there are questions of good taste and abuse of the confidence of the radio audience. It is a significant fact that of all of the users of radio time for advertising dentifrices at the moment, not one has had their preparation accepted by the Council; yet they all bellow and ballyhoo, "Do as your dentist does," "then he saw his dentist," "so he went to his dentist," "your dentist uses," "dentists advise," etc., *ad nauseam*. The dental profession is already aware that the character of such advertising is such that it could not be countenanced by the Council.

Continuance of this nuisance over the radio and in advertising can be interpreted only as evidencing a disregard of the public's feelings by those who make these claims and by those who encourage them. The abuse of the dentist's authoritative position in advertising over the radio has become as cacophonous as the advertising of laxatives, which the broadcasting chains have already had the good taste to discontinue. It is time to begin a cleaning up of oral advertising.

CHLORATE AS A CONSTITUENT OF A TOOTH PASTE

Because of the Council's consideration of Pebeco Tooth Paste in 1931, a member of the Council has undertaken an extensive investigation of the chlorate question, with particular reference to dentifrices and mouth washes containing it. This investigation is still underway. The following preliminary statements are offered as a guide to the dental profession and the public.

The possibility of danger of acute poisoning from swallowing a tooth paste containing chlorate is always present. The acute effects are probably not so important as the possibilities of injuries resulting from the continued use of such a dentifrice or mouth wash. This was emphasized in 1931 when the Council examined Pebeco Tooth Paste. The repeated use of chlorate in a dentifrice or mouth wash presents a problem somewhat different from that associated with the acute poisoning which may result from swallowing a large quantity. A question arises as to the rational basis for the inclusion of chlorate as a constituent of a dentifrice or a mouth wash. It liberates neither oxygen nor chlorine in the mouth, as was once supposed. The use of chlorate in a dentifrice is essentially empiric, but its use persists in this country.

The Austrian government has decreed that not over 10 per cent of potassium chlorate should be permitted in a dentifrice for cosmetic purposes. Dentifrices that contain over 10 per cent can be purchased only on a dentist's or a physician's order. In this country, the purchase of dentifrices with a high content of chlorate is unrestricted. The Austrian decree implies that 10 per cent or less of potassium chlorate is relatively safe or noninjurious. Nevertheless, the question remains whether the use of chlorate is without harm.

Chlorate has generally been classed with salts that produced methemoglobinemia. It has been shown that this phenomenon generally occurs in fatal poisoning from chlorate, but serious injuries can occur without methemoglobin formation. Injections cause degeneration in the liver and kidneys. Accordingly, the referee is reinvestigating the question of methemoglobinemia as applied to this drug and some others capable of producing it.

The choice of animals is important, because rodents, on which most of the older work has been done, do not readily produce methemoglobin. Other animals must be used that

are more susceptible to changes in blood resulting in formation of methemoglobin. The spectroscope is commonly used for detecting methemoglobin, but this is the least sensitive method, since at least 25 per cent of methemoglobin is required to obtain an indication of its presence. This is a very high content, and serious visceral injuries may occur long before this amount is reached. The investigators have therefore chosen a more effective method for the investigation.

The experiments are being extended with lower concentrations to determine the minimum dose that would produce the degenerating effects obtained with higher doses.

Preliminary results on ciliary function, which is thought to be important in the maintenance of resistance in the throat, also indicate injurious effects, which increase with increasing concentration of chlorate.

Chlorate is reported to be absorbed from the oral mucosa. When one considers the effect of absorption from lesions of the mouth or discontinuous gum tissue, absorption might be even greater than from the intact oral mucosa.

Consequently, the Council suggests caution in the use of tooth pastes containing potassium chlorate. The Council is aware of the promiscuous exaggeration of the dangers of chlorate made by some public writers. The danger appears to be not so much from acute poisoning as from the possibility of injuries from continued usage over a long period of time.

The therapeutic status of chlorate appears questionable in view of undemonstrated benefits from this salt and the absence of reasonable expectations of such from its properties, and because of the potentialities for harm from continued usage.

FLUORIDE-CONTAINING DENTIFRICES

A patent has been issued by the U. S. Patent Office for a dentifrice that contains as one of the important ingredients sodium fluoride. Claims that it will whiten teeth by virtue of the fluoride content are permitted. This was investigated by a collaborator in the laboratory of a member of the Council because of the fact that a patent for an essentially toxic substance in a dentifrice had been issued, and consideration of dentifrices is needed because of the presence of potentially toxic substances which appear in dentifrices from time to time.

An investigation undertaken in the referee's laboratory indicates that the visual effects of fluoride toxicity did not appear in the doses used. Other considerations render the use of fluoride in dentifrices for bleaching teeth unscientific and irrational, and not permissible in a patent. A detailed report will appear later.

MILK OF MAGNESIA DENTIFRICES

There are several dentifrices on the market labeled "Milk of Magnesia Tooth Paste" or "Milk of Magnesia Tooth Powder." A milk of magnesia tooth paste or milk of magnesia tooth powder in the strict sense of the word does not exist. Milk of magnesia refers to a definite product, the standards for which are laid down in the Pharmacopeia. After admixture, it is no longer the pharmacopeial product. Oftentimes, other magnesium compounds than those present in milk of magnesia are added, and the product is labeled milk of magnesia dentifrice. The Council therefore concluded that it cannot accept such designations. It will adhere to its present position for naming dentifrices, but those manufacturers who desire to call attention to alkaline magnesium compounds present in their dentifrice may have on the label a supplemental statement such as "compounded with . . . % milk of magnesia" or "contains magnesium hydroxide equivalent to . . . % milk of magnesia." This will indicate to the prescriber the content of alkaline magnesium compound if he is interested in seeing that his patient secures such a compound in a dentifrice. (The North Dakota Food and Drug Department and the New Hampshire State Board of Health have recently called attention to similar circumstances in the labeling of "milk of magnesia" tablets.)

BUREAU OF PUBLIC RELATIONS

ECONOMIC VALUE OF DENTAL HEALTH EDUCATION IN PUBLIC SCHOOLS

By HENRY CLINE FIXOTT,* D.M.D., F.A.C.D., Portland, Ore.

"DENTISTRY is a profession whose prime purpose is service to humanity." The quotation is from Section 12 of the Code of Ethics of the American Dental Association. This section goes on to say, "Dentists should be good citizens and as such should bear their full part in sustaining institutions that advance the interests of humanity. They should be ever ready to counsel the public on subjects relating to dental health service."

That the dental profession is fully cognizant of its responsibility in this respect is amply evidenced by its record. It has always been in the forefront of those who give of their time and their energy to promote those things that are of real value to community interest and public welfare. It stands shoulder to shoulder with the medical profession in the unselfish giving of time, thought, energy and knowledge for the creation, preservation and maintenance of health in mind and in body. It is not remarkable, therefore, that, for many years, the dental profession has been such a staunch advocate of dental and medical inspection, treatment and education, in industry, in state institutions and in public schools. Such action is but the normal result of research and experience and a knowledge of humanity's need.

*Supervisor, Dental Department, School District No. 1.

The Committee on Dental Health Education of the American Dental Association, in cooperation with the United States Public Health Service, is at the present time engaged in an intensive study of the problem of lay education. Pamphlets on dental education, radio talks, lectures and newspaper articles, health exhibit material for schools, etc., are being developed, corrected and approved by these organizations, and it is their intention that an intensive educational program be prepared on the subject of dental care that the message may be broadcast and every individual person may benefit thereby.

While radio talks and lectures to adults do have a definite effect, the problem of dental education is one that should start at the bottom, in order that a greater good may be done for humanity by having adequate systems of dental health education in our public schools, so that, from the time they are of school age until they go into the high schools, children are continually and properly informed as to the health value of dental care.

It will be my purpose to call attention to the development of dental health education and care in state and national institutions and in industry, and to particularly emphasize the value of an adequate dental health program in public schools.

VALUE OF DENTAL CARE RECOGNIZED BY CITY AND STATE AUTHORITIES

In their general health program, many countries, states and cities have adopted a plan of dental education and care. Dental departments have been established in state institutions, asylums, penitentiaries, hospitals, children's homes and sanatoriums. In general, wherever there is a lowering of the physical and mental resistance, it has been found that a dental program does much to alleviate and overcome the condition. An illustration follows.

In the year 1907-1908, St. Vincent's Orphanage, Boston, Mass., reported 109 cases of various illnesses, such as diphtheria, mumps, scarlet fever, pneumonia, measles, tonsillitis, whoopingcough, chickenpox, typhoid fever, croup, tuberculosis of the eye and tuberculosis of the lungs. In 1908-1909, there were 103 cases. Dental care began in 1910, and in 1909-1910, the number of cases dropped to eighty-five, and in 1910-1911, to fifty-two. From April, 1911, to May 1912, there were two cases, and from May, 1912, to May, 1913, there were no cases of disease. In 1913-1914, there were but seven cases. This remarkable improvement was, without doubt, partly due to the removal of disease germs from unclean mouths. These statistics offer a startling illustration of the fact that where dental infections have been eliminated and corrected and children have been taught to care for their mouths and to keep them clean, there is found a material reduction in susceptibility to those diseases incident to childhood. Thus, the expenditure of funds by city and county authorities for dental health education becomes logical and worth while.

An interesting report comes from the Indiana State Board of Health. During an epidemic of scarlet fever at Valparaiso, Ind., O. B. Nesbit undertook to control the spread of the disease by the care of the school children's mouths and teeth. In 976 mouths inspected, 4,796 cavities were found. The improvement of mouth conditions was followed not only by a subsidence of the epidemic, but also by a notable improvement in efficiency and general health.

Haven Emerson, in examining 1,478 poor children admitted to Sea Breeze Sanitarium, Long Island, found 1,200, or 81 per cent, with an average dental decay of four and seven-tenths teeth each. What is to be done for these children? To allow their physical ailments to go untreated is to bring to manhood a host of weakened, diseased young men. And it must be remembered that an uneducated person may be less of a menace to society than a diseased person who has had the ordinary schooling.

RECOGNITION OF THE VALUE OF DENTAL CARE IN DENTISTRY

At first, dental and medical inspection, like public education, was established as a means of relief for the poor, with little thought of the great benefit that was being rendered in the building of a better body and a better mind. Nor was there thought of the dollars and cents value to the community. Today, we are fully aware of the physical, mental and financial economy of dental health education.

In the recruiting of soldiers for the World War, more applicants were rejected because of defective teeth than for any other single reason. The argument for having sound teeth is not founded on a desire to prepare young men for war, but if dental health is a necessity for the health and endurance of soldiers, it stands to reason that it must be a great help in the ordinary struggle for existence.

Many industrial institutions, finding that dental health materially increases physical well-being, mental poise and effi-

ciency, have established clinics in their plants to care for the dental needs of their employes.

DENTAL HEALTH EDUCATION AND CLINICS IN PUBLIC SCHOOLS

There was a time when compulsory education was considered by a majority of people as an invasion of their rights. There are probably more than a million illiterate adults who are victims of this mistaken theory. It is true that the cry for medical freedom, and the parent who lays the responsibility for the cure of pus-laden adenoids and diseased teeth on the Lord, are still with us. Few today dispute the rights or injustice of compulsory education, and people are now clamoring for compulsory dental health education as well.

In 1894, Boston established a regular system of medical inspection in the schools. In 1911, according to Leonard Ayres, of 1,046 school systems examined, 443, or 43 per cent, had medical inspection of school children, and of these 443 cities, 354 employed school physicians. In the more advanced and comprehensive systems of medical inspection in the schools of the country, we find that the definite aim is to learn as much about the child's body as the teacher does about his mind. It has been determined that even the highest type of medical and dental inspection will fail of its best unless it is backed up by a school clinic for free medical and dental treatment of indigents.

Dental inspection and education in the public schools is a very definite means of bringing to the child the knowledge of the importance of dental care, for personal appearance, comfort and ability to play, study and work and for his general welfare. Also, it is a means whereby parents may be notified of the existence and effect of dental disability in their children, and become informed as to the importance of dental care for themselves as well.

In the past, it might have been truly said that when the child is directed to the family dentist, there the matter usually ends. This disregard of such warning is illustrated in the report by early New York inspectors that 94 per cent of their notifications to parents failed to bring results. Such conditions no longer exist. Parents have awakened to the importance of dental and medical care for their children and they are doing much to correct such mistakes.

The fact that the condition of the mouth and the teeth often retards physical development and has an important bearing on the ability and inclination of children to apply themselves to their school work and keep in good physical condition is well known to educational authorities everywhere. The departments of education of Long Beach, Oakland, San Francisco and Los Angeles, Calif.; Kansas City, Mo.; the State of Kansas; New York City and State; Cleveland and Cincinnati, Ohio; Chicago, Ill.; St. Paul and Minneapolis, Minn., and many other cities and states have established departments of dental health education and care as part of the school system. The department of education of the Hawaiian Islands had a program calling for the expenditure of $196,130 for a two-year period ending Dec. 31, 1933, supporting eight full-time dentists and one part-time dentist, thirty dental hygienists and one supervising hygienist.

School authorities say that, from the standpoint of physical growth and development, when the health of the child has been cared for, a decided improvement in posture, in weight and in general interest and vivacity is noted.

Mental growth and development also show a marked improvement when dental ills have been corrected. Children are

better able to study and their school marks show the effect. They are more interested and effective in their games, playing with more vigor, and a marked improvement in deportment is noted. The reduction of retardation, truancy, etc., more than repays the expenditure of the necessary money and effort to carry on such a work.

Oral infection is more far-reaching in its detrimental effects than just to those affected directly. It goes out into the community. This is amply illustrated in developing the program of dental health education that was undertaken in Bridgeport, Conn., by Alfred C. Fones several years ago. One of the pertinent facts brought out by that experiment was that the cost of reeducating children who failed of promotion at the end of the year, which had been 42 per cent of the school budget in 1912, fell to 17 per cent after a five year program. This result was brought about largely by the removal of disease germs that lurk in unclean mouths and decayed and infected teeth, and by an awakened public interest in oral hygiene.

The annual report of the Portland public schools for 1929-1930 shows that it costs $90.50 per pupil to educate repeaters, and $182.28 per year to educate children in ungraded rooms. Thorough dental prophylaxis and correction materially reduces the number of repeaters and the number of children that have to be segregated in ungraded rooms in our school system.

During the past year, more than 28,000 operations were performed, for 3,500 children, an average of eight operations per child, at an average cost of 40 cents per operation. So it will be seen that the expense of reeducating one repeater would take care of the dental rehabilitation of twenty-seven children in the school clinics, and sixty children could be cared for at the cost of keeping one child in an ungraded room. It is far better to spend money for prevention than for a possible cure.

A BRIEF DISCUSSION OF THE PORTLAND CLINIC

About twenty-five years ago, the Portland District Dental Society inaugurated a plan of dental education and care in the public schools of Portland by making an examination of the mouths of school children. This was done by volunteer work on the part of members of the Association. Dentists visited the school, examined the mouths of the children, charted the needed work and did much of the work that was necessary for those underprivileged children whose parents could not afford to have them cared for otherwise. A mass of information was gathered and much good was accomplished.

It was found that less than 15 per cent of the children brushed their teeth with any degree of regularity.

After the inauguration of the voluntary service and examinations in the schools, the city appropriated a small sum to establish a clinic in the city hall. This clinic was open only on Saturdays, and a dentist was placed in charge to take care of children whose parents could not afford to have dental work done in the usual manner.

In 1916, with the assistance of Mr. H. M. Barr, then principal of the Buckman School, a child welfare dental clinic was conducted by a committee of the Portland District Dental Society to determine, if possible, the actual value of oral health to school progress and physical development.

In this experiment, thirty-eight pupils were selected in the Buckman School and divided, twenty-three being used as a control class, for whom no dental or

other service was performed, and fifteen as a test or experimental class, whose teeth were repaired by dentists and their mouths cleansed, after which they were given weekly inspection, toothbrush drills and talks on the care of their teeth.

The following statements are taken from Mr. Barr's report on the results obtained[1]:

According to the reports of the teachers, eight of the fifteen children in the experimental group improved in scholarship during the year, six showed no unusual change and one grew worse; a net gain of seven, or 46.7 per cent. In the control group, seven improved, ten showed no unusual change and six grew worse; a net gain of one, or only 4.3 per cent. The net gain in scholarship of the experimental group over the control group was 42.4 per cent. In concentration and industry, eight of the experimental group improved, four showed no change and three grew worse; a net gain of five, or 33⅓ per cent. Of the control group, seven improved, five showed no change and eleven grew worse; a net loss of four, or 17.4 per cent. The net gain of the experimental group over the control group was 50.7 per cent.

In the records of promotions just compiled for the year 1916-1917, I find that of the twenty-three children in the control group, eleven missed one grade and one missed two, a failure in over 50 per cent of the cases. Of the experimental group, of fifteen only five missed one grade, and one actually made a double grade, a failure only in 33⅓ per cent. In no case was any child pushed, coached or favored. Even to give undue encouragement to any child was to violate the conditions of the experiment.

1. Barr, H. M.: Report on Child Welfare Dental Clinic 1917, Northwest J. Dent., August, 1917.

Shortly after the Buckman school experiment, the Junior Red Cross undertook to assist the dental society in sponsoring the dental clinics in the public school and a sum of money, about $6,000 a year, was raised. Two or three portable clinics were placed in the schools with a dentist in charge and a dental nurse to carry on the work of education. These efforts were materially advanced by the Portland Rotary Club, which contributed about $6,000 in one or two years. Later, additional funds were advanced by the city and by the school district, and the school administration took over the dental department as a definite and necessary educational activity.

TABLE 1.—PERCENTAGES OF CHILDREN HAVING DENTAL CARE

Year	1924	1932	1933	1934	1935
Children having toothbrushes	65	90.8	99.4	99.2	99.7
Children visiting dentist occasionally	48				72
Children visiting family dentist regularly	15	18	18.5	19.2	22.5
Children habitually keeping teeth clean	15	64.5	76	83	84.5

The work of the dental department of School District No. 1, Portland, is under the direction of a supervisor, appointed by the school administration, who, in turn, is counseled and advised by the school clinic committee of the Portland District Dental Society.

The department operates five clinics in all: four portable clinics visiting the various schools once each year for from five to thirty days each, according to the need, and a central clinic located in the administration building. Each clinic is in charge of a regularly licensed dentist and a dental assistant or nurse. The dentists are employed full time and are in charge of operative work, consultation, examinations, etc. The nurses are employed full

time. They assist the dentist, keep instruments and equipment in order, keep a careful record of all work done, make home visits to parents when necessary, instruct all children in the grade schools on oral hygiene and assist the principals and teachers in keeping record charts and information complete.

At least twice each month, the dental nurses visit the schools to examine charts and to give talks and demonstrations. In this way, the 33,000 children in the elementary schools are examined and instructed in oral hygiene from two to three times each year, and complete information is kept as to the results.

Record charts are kept for each pupil in the elementary schools. Every three months, they are given credit for (1) having a toothbrush, (2) visiting the family dentist regularly and (3) having clean teeth.

Table 1 shows the increased interest of Portland school children in clean teeth and visits to the family dentist over a period of ten years.

Many schools have 100 per cent sections where every child is brushing his teeth regularly and endeavoring to keep them in good condition. During this period, there has been a steady growth in the number of schools having a high average of children keeping their teeth clean.

The improvement noted in these tables is largely due to regular visits and instruction by the dentists and dental nurses in charge of the clinics, and to the instruction given by gymnasium and health room teachers in the schools. We find that today practically 100 per cent of the children possess toothbrushes.

In addition to this instruction, children are referred to their family dentist for treatment of dental defects. To many children, the cost of private treatment is prohibitive, and to allow dental ailments to go untreated is to penalize these children and possibly retard their physical and mental development. The only solution of the problem is the establishment of school dental clinics to care for these underprivileged children.

Professor Barr, who was principal of the Buckman school in 1917, makes the following statement in regard to the outcome of the Buckman school experiment:

Table 2.—Increase in Number of Schools Showing High Average in Oral Cleanliness

	1932	1933	1934	1935
Number of schools having 90 to 100% clean teeth	2	8	17	20
80 to 90% clean teeth	14	21	31	31
70 to 80% clean teeth	23	25	20	17
60 to 70% clean teeth	20	11	3	
50 to 60% clean teeth	7	3		1
Below 50% clean teeth	1	3		

It has been almost eighteen years since the dental experiment at the Buckman School brought to the attention of our Portland people the relationship between dental neglect and low educational efficiency, and, conversely, the connection between care of the teeth and improvement in scholastic standing.

Since that time I have had almost daily opportunity to test the validity of our findings. As principal of a large elementary school, director of our department of research and supervisor of classes for handicapped children, I face the constant problem of discovering the causes of pupil failure. Our first line of attack is the physical examination. The percentage of children whose low standing in school work is ac-

companied by some physical defect is a challenge to every teacher and every parent. While it is true that the causes of mental backwardness are always complex, so that it would be scientifically inaccurate to ascribe failure to any one physical defect, the fact remains that we cannot expect full class-room efficiency if even the slightest physical ailment is present.

That experiment in Buckman had a very practical outcome. Thanks to the enlightened initiative and cooperation of the local dental association, Portland undertook a much more extended program of dental education and care than had ever been contemplated by the local school authorities. The results have been most gratifying. Throughout our schools, children have begun to take pride in the appearance of their teeth. The influence of the class-room has spread into the home. Parents have become enlightened enough to consult the family dentist at the very first sign of dental decay. Principals and teachers are quick to check all cases of school failure and to insist on some sort of remedial care.

The entire community have reason to be grateful to the local dental association, for inaugurating the measure not only to improve the physical health of our children, but also, through that improvement, to raise the standard of the entire school system.

G. Walter Dittmar of Chicago, professor of prosthetic dentistry in the University of Illinois and former president of the American Dental Association, when in Portland a few months ago, evinced great interest in the subject of dental education and clinics in the public schools and it was my pleasure to take him on a visit to the school clinics. Of his visit, Dr. Dittmar has this to say, "I certainly was greatly pleased with the work I saw being conducted here and I cannot praise it too highly. I can truthfully say that the school work being carried on to aid the children's health in Portland by the dental clinic department of the public schools is as excellent as is done in any other city in America, better than many of them." Dr. Dittmar said further, "Many diseases can be prevented by taking care of the teeth. This should begin early. . . . The medical and dental professions can never successfully cope with diseases until the laymen thoroughly cooperate with them. Preventive medicine and preventive dentistry are much less expensive than curative medicine and curative dentistry."

In the spring of 1934, the United States Public Health Service undertook a survey of dental conditions among the elementary school children of the nation. Such a survey was made in Portland by taking nine schools, three of the schools in those districts where most of the peo-

TABLE 3.—SUMMARY OF DENTAL SURVEY FOR U. S. PUBLIC HEALTH SERVICE*

				Number	Per Cent
Examinations		4,471	Perfect mouths	193	4.3
Dental treatment indicated			Yes	3,844	81
			No	627	19
Dental treatment received			Yes	3,249	72.5
			No	1,226	27.5
Type of treatment received	Prophylaxis			1,775	40
	Fillings			2,518	56
	Extractions			438	10

Number of teeth filled: deciduous, 3,482; permanent, 7,466; total, 10,048; fillings in good condition, 10,961 or 3+ per child.

*Dental survey of 15 per cent of Portland's grade school population.

ple were thoroughly trained and educated in the care of their teeth and of their health, three of them in the middle group and three in the outlying districts where dental and other care was negligible. A summary of this survey is given in Table 3.

The findings noted are in marked agreement with those given in a report by A. W. Herrington[2] on work done by the public health dental program in Missouri in 1931-1932. In 1931, of 120,180 children examined by dentists, 16 per cent were normal and 84 per cent needed dental attention, and there was an average of three and eight-tenths defects per child. In 1932, of 65,366 children examined, 11.9 per cent were normal and 88.1 per cent needed dental attention, and there was an average of four and two-tenths defects per child.

Dental health education and care for children in the public schools has a threefold economic value: (1) the prevention and cure of disease, (2) the building of a strong, healthy body and mind and (3) prevention of waste of money given by taxpayers for education. The first and second values will best be illustrated by a brief history of an actual case in the Portland Public Schools.

REPORT OF CASE

E. L., a girl, aged 10, from Doernbecher Hospital outpatient clinic, where she had undergone an operation on tonsils, from which she did not improve, complained of a pain in the right side and abdomen. On examination, there were no signs of appendicitis. The patient was referred to the school dental clinic and seven abscessed deciduous teeth and five badly decayed permanent teeth were found.

Jan. 24, 1934, on her first visit to the dental clinic, she weighed 65 pounds. Her posture was very bad and she could scarcely walk from the car line to the building, a distance of 2 blocks. Her skin was sallow and she seemed to be a very sick child. Her mother said that she refused to eat unless forced to. Her school attendance record was poor and her scholarship below average. At this visit, three deciduous teeth were extracted and one permanent tooth filled. On her second visit, she was still a very sick girl. Three more deciduous teeth were extracted and one treated. On subsequent visits, she was much improved and her mother reported that she was really enjoying her food and had gained 2 pounds in weight.

All dental work was completed by March 9. The patient now weighed 75 pounds and enjoyed her work and play. Her report card showed two more E's than the preceding month and only one G. Her disposition had equally improved. The teacher now considers her one of the best pupils in the room. The teeth were examined and cleaned in December, 1934. No other dental attention was needed. The patient was again examined, April 24, 1935 and no dental attention was found necessary. The patient now weighed 81 pounds and was 59 inches tall. Her color was good. Her school attendance record, application and deportment were good. Her scholarship averaged E. Parents and physician credit her remarkable improvement entirely to the dental care that she received.

The following statements made by Prof. Charles A. Rice, superintendent of schools, District No. 1, Portland, will amply illustrate the third value, waste prevention:

The total budget collected each year to operate the Portland school system is approximately $5,000,000. Even with the elimination of the debt fund which is merely payment for previous expenditures, the sum collected each year for current operations is about $4,000,000.

These vast sums of money are provided by the general public for just one purpose, and that is to insure the maximum mental, emotional and physical development of

2. Herrington, A. W.: Public Health Dentistry in Missouri, J.A.D.A., 20:1298 (July) 1933.

Portland's school children. The construction of school buildings and the employment of teachers and all of the other adult personnel are merely a means to an end. The primary goal of any educational program is the welfare of the child. A school system which makes any pretence to efficiency must be child-centered, because that is the criterion of its success.

It follows, therefore, that any condition which handicaps young people or which prevents them from giving maximum attention to the tasks set before them by the school is so much grit in the machine. While it is present, there can be no possibility of efficient performance. The handicap must be removed before we can expect our pupils to do satisfactory work.

No one who has ever experienced an aching tooth or has had personal knowledge of what the seepage of pus from decaying teeth can do to a human system needs statistical proof to convince him that neglect of the teeth must have an injurious influence upon class-room attention and school performance. We give race horses the best of care, because we realize that unless the physical condition is perfect, they cannot run to victory. We are beginning to give careful attention to the diet of our young people because we realize that unless there is good physical tone, it is impossible to expect prolonged effort or steady concentration. It seems obvious that we cannot expect very much either in physical development or in healthy mental hygiene of our pupils, if neglected teeth interfere with good digestion and disturb the mind with intermittent pain.

Our dental clinic has a total budget of less than $20,000, or one-half of 1 per cent of our current operating expense. That $20,000 may have an important influence on the dividends which the Portland taxpayer can expect from the $4,000,000 he contributes toward the maintenance of our local school system. It may save many times that sum in preventing educational waste and increasing pupil efficiency. It certainly would be poor business to spend over $30,000 in fire insurance premiums merely to protect the school buildings against destruction by fire, and then object to spending much less than that to insure our children against destruction of learning by ill-health. Health inspections and health clinics are humanitarian services necessary to give our young people a more vigorous and more abundant life. They are also an insurance to the taxpayer that the vast sums of money he gives annually for the physical and mental growth of our young people are not wasted through preventable illness and physical defects in our children.

Dental education, inspection and clinical treatment go hand in hand and, to be successful, must be closely related to school work and to school aims. They must take their place in the school curriculum, but to do so must be backed by the same authority as the rest of the curriculum.

CONCLUSIONS

1. It is the duty of the dental profession to inform the people of the dangers of oral infection and neglect and to educate them in the care of the teeth, the prevention of dental disease and the value of such care as a factor in the development and maintenance of a healthy body and mind.

2. The American Dental Association and the United States Public Health Service should be encouraged and helped by every member of the dental profession in their efforts to formulate an effective program of dental health education.

3. While education of the adult is important, education of the child is most necessary and effective, and the public schools offer the best medium of reaching every child and, through the child, the home.

4. Wherever a properly organized dental educational program has been undertaken in the public schools, the results have more than justified the effort and expense and have proved that dental

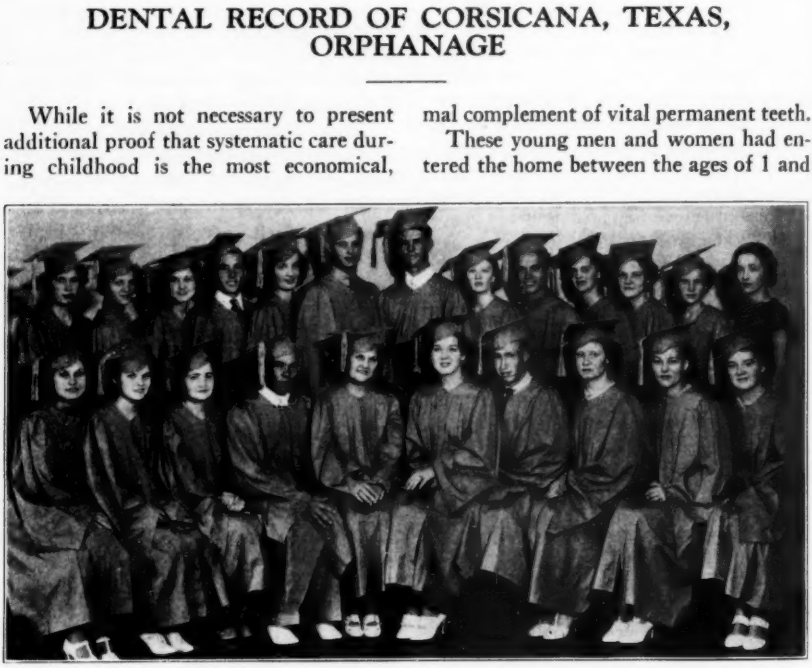
health education and care are of sound economic value.

5. The dental profession should interest civic and school authorities in the establishment of dental health education and should be prepared to offer competent professional advice and cooperation in the organization and operation of such a program.

729 Medical-Dental Building.

DENTAL RECORD OF CORSICANA, TEXAS, ORPHANAGE

While it is not necessary to present additional proof that systematic care during childhood is the most economical, sane and satisfactory way to preserve the teeth, the following report by Trim Houston, of Texas, is an important contribution to the growing mass of evidence regarding the value of child dentistry.



1936 Corsicana Orphanage graduating class, all members of which were dentally perfect on graduation.

In May, 1936, the Corsicana, Texas, Orphanage graduated thirty-three high school students, who averaged 18 years of age. Each student left the institution as near dentally perfect as it was humanly possible to make them. All had the normal complement of vital permanent teeth.

These young men and women had entered the home between the ages of 1 and 14, the average entrance age being 9. In most instances, their family history and environment prior to their entrance was not good. The father in all cases, and in many the mother, had died. Buffeted by fate, these children had been deprived of even ordinary care and comforts. Dental attention before admittance to the home was an unknown quantity to the average entrant.

All this was changed as soon as the

child came to the orphanage. Located outside the city limits, this children's home consists of several buildings, which are modern in every respect. The spacious grounds afford plenty of room for outdoor exercise, and both boys and girls are encouraged to participate in athletic sports.

The diet is simple but ample, consisting of meat, generally fresh, once a day; plenty of vegetables and fruit, fresh whenever possible, and an abundance of fresh, pure milk from the home's own dairy. Sweets are a rarity, the children receiving about one third the amount consumed by the average American child. Only on very special occasions do they get soft drinks or tidbits between meals.

The children are kept under medical supervision, being examined regularly for congenital or acquired defects or disease. When found, the defects are immediately treated and, if possible, corrected. Once every six months, the children have a complete dental examination. The smallest defects are corrected and all stains and tartar removed. During the past several years, prophylactic odontotomy has been practiced persistently. Naturally, the greater percentage of dental corrections are made during the first eighteen months after the child enters the home. Subsequently, each new defect is corrected when discovered. Toothbrushes, salt and water play a prominent part in each child's daily dental régime.

Dental irregularities are negligible, there being none worth considering among the children who entered the institution at an early age. The gums and alveolar process are healthy and normal, except in a few children suffering from congenital handicaps which they have been unable to overcome.

This year's graduating class adds another to the long list of similar classes that have graduated from the home high school with sound teeth. Few, if any, municipal high schools can boast of the same record.

St. Paul Evangelical Lutheran School

For the eighth consecutive year, the St. Paul Evangelical Lutheran school of Melrose Park, Ill., which is the largest elementary school of its kind in the country, has graduated its eighth grade pupils dentally fit. No child had any cavities, diseased or unclean teeth or infected gums. It is believed that few, if any, other schools in the country can boast of such a record.

Disease Conditions of the Mouth and Their Relation to Health

Prepared by the American Society of Oral Surgeons and Exodontists, the new 15-page booklet, "Disease Conditions of the Mouth and Their Relation to Health," is just what you have been waiting for. It explains, in simple lay language, the principal factors involved in oral disease. Among the subjects covered are: consultations; infectious diseases; infected teeth; chronic tooth infection not painful; dental x-ray pictures; pulpless ("dead" or devitalized) teeth; removal of teeth; acute infections of cheek and neck; choosing the anesthetic; impacted teeth, and cancer of the mouth. Its small size, $3\frac{1}{2}$ by $5\frac{1}{2}$ inches, enables the patient to slip it into the pocket or handbag.

Approved by the American Dental Association and the U. S. Public Health Service, it is distributed by the Bureau of Public Relations, American Dental Association, 212 East Superior Street, Chicago, Ill.

Single copies, 5c; 25 copies, 50c; 50 copies, 75c; 100 copies, $1.25.

What It Means to Be a Dentist

Copies of the article, "What It Means to Be a Dentist," by L. E. Blauch, Ph.D., which appeared on page 1370 of the July, 1936, JOURNAL, are now available in reprint form.

Dr. Blauch, who is not a dentist, but an educator, has recently devoted four years to an extensive study of dental education in the United States and Canada under the direction of the American Association of Dental Schools. Many dentists will want this reprint to give to their patients or to young men who contemplate entering the dental profession.

Single copies, 5c. Prices on quantity orders on request.

Care of the Teeth Booklets

Over 29,000 copies of the "Care of the Teeth" booklet were distributed during the month of June. One state health department ordered 20,000 copies, another 5,000 copies and two others 1,000 each, for use by their dental hygiene divisions. Individual orders brought the total close to 30,000.

Radio Talks

The Bureau of Public Relations has on hand mimeographed copies of approximately 150 radio talks, ranging from five to fifteen minutes in length. About half of this number, which have been prepared by the Bureau during the past year and a half, bear the official approval of the American Dental Association and the United States Public Health Service. All of these talks are available for use by component societies.

Price, 5c each.

The Army Medical Library—The amount of space occupied by the Army Medical Library in Washington during the early years was so small that the boxes of books had to be opened in the yard. Congress then appropriated $200,000 for a building, and in 1887 the present three story building occupied by the library and museum at Seventh and B streets S.W. was opened to the public. That building has been occupied for fifty years and has long since been outgrown. The overflow of books now crowds the basement and every nook. The need for a larger building was so obvious as long ago as 1919 that Congress purchased a new site for the library at the Army Medical Center on the outskirts of Washington. The Army Medical Library has now more than 941,181 volumes. It has about 19 per cent as many volumes as the great Library of Congress, and yet it receives about 9.8 per cent as large an annual appropriation for purchases. It has some of the rarest books in the world. Of about 600 medical incunabula known, it has 450. The Army Medical Library has the only known copy of some medical works. It contains a more complete file of French theses than the Library of the Medical Faculty of Paris. In addressing the International Medical Congress in London in 1881, Billings said: "If the entire medical literature of the world, with the exception of that which is collected in the United States, were now to be destroyed, nearly all of it that is valuable could be reproduced without difficulty."—*J.A.M.A.*, May 16, 1936.

DENTAL ECONOMICS

WHAT THE ECONOMICS COMMITTEE OF THE AMERICAN DENTAL ASSOCIATION IS DOING*

By LON W. MORREY†, D.D.S., Chicago, Ill.

AMERICA'S present dental dilemma is the direct result of our national neurasthenia. Our dental economic problems, arising in part from our individual inadequacies, are in part an outgrowth of the current condition of our country.

Dental prosperity is so closely interwoven with the state of our national prosperity as to be almost entirely dependent on it. Most of us realize that our personal practice is directly affected by local conditions. The closing of the village bank, the bankruptcy of the town industry or the failure of the community crops are known to reduce our income. Some of us fail to realize that our personal practice is influenced even more by remote, unseen forces and activities arising in what we vaguely refer to as national and international spheres. Never should we forget that the country's problems are our problems and that the world's worries are our worries; that any action or inaction that perceptibly affects the national income is going to be reflected in our balance sheet. Dentistry's destiny is woven into the warp and woof of our social fabric. Our lives and our prospects are brightened or darkened according to light and shadows woven into the tapestry by the shuttle of time and events.

Look back at the fruitful years between 1920 and 1930: That decade can rightfully be termed the halcyon days of dentistry. During that period, dental educational standards were greatly advanced; dental technic was perceptibly improved; dental research gained noticeable recognition both in and outside the profession; the value of preventive dentistry and children's dentistry became somewhat fixed in the public mind; patients demanded a higher quality and greater quantity of dental care—all of which improved the dentist's social and economic standing. During those ten years, a gigantic wave of speculative prosperity swept over the land and we rode the wave. During that period, it was born in on the consciousness of dentistry that ours was indeed a noble profession, a necessary profession, and that the practitioners thereof were independent, self-sustaining persons.

Blinded like most of our neighbors by the sudden inrush of prosperity, most of us managed to blunder into many and varied misfortunes. Rural dentists bought 200-acre farms at $200 an acre. Urban dentists bought 200 shares of stock at $200 a share. Not that we were interested in raising stock, but we were interested in raising the price of our

*Read before the Section on Dental Economics at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 20, 1936.

†Secretary, Committee on Economics.

stocks, and our other investments. Country club rosters were crowded with the names of prominent dentists—and almost all of our dentists were prominent. Two cars for each family was the rule far oftener than it was the exception. The more affluent of dentists needed at least two assistants, two days out of the office each week and two vacations each year. Wives spoke patronizingly at the women's club of an exclusive finishing school for Helen and a boarding school for Junior. The occasional dentist who was employed by the government, state or municipality was looked on as being slightly queer, if not entirely demented. The word or the meaning of the word economics had never penetrated our brain. Dentistry rode the wave of prosperity and sat well up in the front seat.

Overnight, this bountiful wave of prosperity developed into a tidal wave of destruction. Our dream house of cards tumbled. Our financial foundations flattened like the shifting sands of the seashore. Our 200 acre farms, our $200 stock, our two automobiles, two clubs, two assistants and two vacations disappeared into the limbo of the lost. Helen's career in the exclusive finishing school was finished and Junior's boarding school was boarded up.

Lifetime savings plus paper profits were washed out and we were washed up. Fortunate and rare indeed was the dentist who did not lose heavily in one manner or another by the sudden crumbling of values. Fortunate indeed was the dentist whose patients did not lose even more heavily. During 1930-1933, the dentist was confronted by a double catastrophe: He not only lost his own financial backlog but he also lost the greater part of his practice because his patients, like himself, had lost their savings and, in many instances, their positions and incomes as well. So rapidly did chaos and confusion follow on the heels of catastrophe during the first three years of the depression that no one, from the highest government official and the most brilliant Wall Street banker down to the confused and ill-advised dentist, knew how to stop the destruction or how to stabilize values. Panic stricken, like drowning men, we clutched our few remaining possessions for support and struggled to keep afloat.

This tightening up procedure, although natural, caused business and the flow of money and credit to become even more static. More industries closed; more employes were thrown out of work; more people went on relief; fewer patients bought dental service; but more and more sufferers needed our service, although they were unable to pay for it. Then we began talking economics. Like little islands of new skin forming in isolated spots on the surface of raw wounds, thoughts and talks and articles on dental economics appeared, spread and developed in an effort to cover our burned and broken lives. At first, most of our thinking, talking and writing, like the times themselves, were somewhat chaotic and confused. What we lacked in coherence, we made up in volume.

Within a short time, the early writers on economics and their followers split into three groups: Those who favored government control of health service; those who opposed such control, and those who were undecided, but who advocated organized dentistry's doing something to safeguard dentistry before some outside agency did something to injure it.

A careful résumé of the articles appearing in the dental journals three years ago indicates that a certain percentage of the dental profession looked with favor on government control. With practices rapidly diminishing and obligations

rapidly rising, is it any wonder many men succumbed to the siren call of state dentistry? In times of stress, we are apt to grow panicky, think incoherently and talk hysterically. The prolonged depression offered a splendid opportunity for socialistically inclined persons and foundations to further the cause of state medicine. Clever and convincing articles on the subject began to appear regularly in the public press and national magazines. These and similar articles in our own dental journals plus our increasing financial instability undoubtedly influenced many men. By 1933, the situation had become desperate: 20,000,000 citizens on relief, most of whom needed dental care; 60,000 dentists with lowered incomes, most of whom needed dental patients; advocates of state medicine making ever-increasing demands and a federal government which apparently looked with favor on supplying those demands.

Between 30,000 and 35,000 members of the American Dental Association split into three great groups and each group in turn split into innumerable lesser groups over the subject of dental economics. Every thinking dentist, both inside and outside the Association, who was interested in the economic welfare of the dental profession developed ideas on the subject. All who could gave voice to their ideas. Many and varied were the plans, and programs presented as panaceas for our problems. There were almost as many plans, it seemed, as there were members themselves. Many of the plans were steeped in emotion and much of the emotion was deep—your plan was wrong because it differed from mine; my plan was right because I was its father; that group was utterly outcast because it evidently practiced birth control and hadn't hastily borne any children.

On this ocean of seething emotions, the present Committee on Economics set sail in 1934. Although inexperienced mariners for such a turbulent sea, it was their duty not so much to calm the dental economic waves as to help steer our craft through the troublesome waters so that all members would be ultimately saved, even though many were seriously seasick.

In 1934, at the Annual Session of the A.D.A. at St. Paul, the Committee on Economics of the American Dental Association was made a standing committee and its membership was enlarged from five to fourteen members, one member being appointed from each trustee district and one from the United States Public Health Service. Each district member appointed a deputy in each state in his district to represent him. It is the duty of each committee member and deputy to keep in touch with all activities in the state that directly affect dental economics and to keep the Central Office informed as to those activities. It is the duty of the economic committee to study the dental economic problem as a whole and report the findings and opinions to the Board of Trustees of the American Dental Association. Through the pages of THE JOURNAL and a news release service, the committee keeps the entire membership informed regarding all dental economic events and activities that are reported to the Central Office.

The present Committee on Economics, appointed in the summer of 1934, came into existence in the darkest hour of the depression. After much deliberation, it seemed to the committee that it was confronted with two problems: first, and of gravest concern, what should be the attitude of the Association toward compulsory health insurance and state dentistry? Should we oppose or endorse such legislation in the event it was proposed? The profession itself was undoubtedly divided on the subject. It was

the duty of the economic committee to recommend the course that would be most beneficial to all members of the whole profession. The second problem that confronted the committee was the recommendation, if possible, of some plan or plans that the Association might endorse which would improve and increase the dental service rendered the public and likewise improve the economic status of our members. Because of its urgency, the committee turned to the first problem first.

In June, 1934, the President of the United States announced his intention of proposing legislation for greater economic security for the American people and indicated, as primary objectives in such plans, the question of unemployment insurance, old age assistance and health insurance. Two months later, in August, 1934, the Committee on Economics presented to the House of Delegates a set of ten principles that it believed would record the attitude of the American Dental Association toward any health insurance legislation that might be included in the President's proposed economic security plan. These ten principles were approved and adopted by the House of Delegates.

In November, 1934, the Board of Trustees of the American Dental Association passed a resolution opposing the enactment of legislation along the lines of so-called compulsory health insurance until the health professions were satisfied that the interest of the public and the professions were properly safeguarded. During the same month, the President of the United States appointed an advisory council to aid in the formation of a program for social reform in the United States. Two months later, Jan. 17, 1935, President Roosevelt sent his now famous social security message to Congress. In this message, he recommended the following types of economic security legislation: unemployment compensation; old age benefits; federal aid to dependent children; federal subsidies for maternal and child health; additional federal aid to state and local health departments, and strengthening of the Federal Public Health Service. The President did not recommend health insurance at that time, but stated that a committee of physicians and dentists were cooperating with the Federal Government in further study of this subject. This committee was to have reported their recommendations to the President by March 1, 1935.

In the meantime, Feb. 18, 1935, after further study and deliberation by both the Committee on Economics and the Board of Trustees, the latter body passed the following resolution:

The Board of Trustees of the American Dental Association believes that the enactment of a program of compulsory health insurance administered by the federal government, the governments of the individual states, or any individual industry, community or similar body would inevitably lead to the regimentation and lay control of dental practice, which would not be in the interest of the public. That a lowering of the standards of dental practice would result is indicated by the evidence from compulsory health insurance legislation in the European countries where it has not only failed to accomplish the measures of alleviation expected of it but also has seriously impeded practitioners of the healing arts in the performance of their duties and has been a barrier to the further scientific development of the professions. The Board of Trustees commends the House of Delegates of the American Medical Association and approves the action pertaining to compulsory health insurance taken at its meeting, Feb. 16, 1935.

As might be expected in an organization as large as ours, every action taken by our officers aroused a certain amount of criticism from those who were op-

posed to that particular action. The ten points adopted by the House of Delegates in August, 1934, drew fire from certain quarters. The resolution passed by the Board of Trustees in November, 1934, drew further condemnation from certain critics because, so they asserted, it was not decisive enough. The fact of the matter is that the November resolution fairly well expressed the Board of Trustees' opinion on compulsory health insurance at that time. A review of the kaleidoscopic events that crossed our horizon during 1933 and the spring and summer of 1934, plus a memory of the conflicting emotions that gripped the profession during that time and the varied opinions explosively expressed by many of our members, will enable one to realize the serious task that confronted our officers. It was their duty to steer the ship of dentistry safely through this stormy sea of conflicting emotions in spite of the occasional waves of condemnation that swept across its bow.

Further study of all available facts and information on the subject of compulsory health insurance and state dentistry in European countries, plus a knowledge of American political shortcomings and a realization of how these shortcomings would adversely affect American dentistry, resulted in the passage of the February, 1933 resolution opposing compulsory health insurance. There can be no doubt that the very unpleasant and usually unsatisfactory experiences encountered by our state dental relief committee members at the hands of the politically appointed state relief commissioners had much to do with bringing about the passage of this resolution. The Committee on Economics had kept in close contact with the F.E.R.A. relief negotiations in each state. With rare exceptions, the reports received from state economic deputies was much the same; namely, that dentistry, in trying to administer to the dental needs of the indigent, had to bow and scrape to the will, the whims and the wishes of the politically appointed relief commissioners. State and component dental societies soon learned that he who holds the purse strings cracks the whip. This experience, so nearly universal throughout the states, plus the launching, early in 1935, of a uniform health insurance measure sponsored by the American Society for Social Security helped to open the eyes of organized dentistry as to what we might expect should compulsory health insurance be adopted in this country. During the first quarter of 1935, this so-called model health insurance bill, the Epstein Bill, was presented to the legislatures of forty-three states. It was introduced in five legislatures and, because of the criticism which it engendered from so many different sources, it was passed by none. It provided for an elaborate, politically administered, state health insurance commission with an intricate system of subordinate district and local commissions and councils. Organized medicine and dentistry were given little or no consideration or representation. In fact, dental service was limited to extractions, amalgam fillings and prophylactic treatments. Even though the Epstein bill was not passed by any state legislature at that time, it will, no doubt, serve somewhat as a model upon which future compulsory health insurance bills may be built.

During the spring of 1935, the eyes of the dental profession were focused on the State of California. Although the American Dental Association and the American Medical Association had both passed resolutions opposing the enactment of compulsory health insurance legislation, the California State Dental Association and the California State

Medical Association were jockied into a position of approving such legislation with certain reservations. Time will not permit giving a complete report on the California situation. Those who wish may read Ernest G. Sloman's report published in the *California State Dental Association Journal,* May-June, 1935, issue.

The California health insurance bill known as Senate Bill No. 454 was introduced by a member of the Senate Interim Committee on April 12, 1935. The bill provided for two types of benefits, primary and additional. The primary benefits as they related to dentistry provided: "The services of a dentist who is a professional service practitioner and who shall be chosen by the patient, for the extraction of teeth, and, on the prescription of the attending physician, such other therapeutic dental services as may be authorized by the Commission." The only dental benefits listed as primary were: (1) extractions; (2) treatment of acute infections, such as osteomyelitis, cellulitis and Vincent's infection, and (3) the treatment of fractures. Additional dental benefits were provided as follows: "The commission shall designate types of dental restoration or replacements or other dental services to be allowed as additional benefits hereunder. The Commission shall, however, permit the beneficiary and his dentist to designate the type of dental restorations or replacements and other dental service or services." Under this arrangement, if and when funds became available and the commission wished to do so, it might provide additional dental services. Such additional services might be paid for in full by the commission, or the commission might pay a percentage of the dental bills for a given period or they might allow a certain number of dollars toward dental bills for a given period or periods. This unwarrantable limitation of dental service, plus the fact that the bill provided no recognition of dentistry on the insurance commission or its advisory council, caused the dental society to introduce several dental amendments to the act. The compulsory health insurance bill "died" on the floor of the senate, with all the amendments that the dental profession insisted on retaining in the bill. Both the California Senate and the California Assembly created new committees to further study the question and to report back to the main legislative bodies in January, 1937. The attitude displayed by the California legislators and their desire to relegate dentistry to a very minor and unimportant position in their health insurance schemes clearly indicates their inability to recognize the health value of our profession; the dental provisions of the "Epstein" bill clearly indicate its sponsors' inability to appreciate the health aspects of dentistry; the attitude taken by politically appointed state emergency relief officials regarding the dental needs of their clientele indicates their lack of appreciation of dental health service; all of which fortifies and justifies the position of the Committee on Economics of the American Dental Association in opposing compulsory health insurance.

The second problem that confronted the Committee was a study of plans and procedures which might provide adequate dental care to indigent and near-indigent citizens. Through our committee members and their deputies, we combed each state and community in an effort to learn of dental health plans in operation that were designed to meet the needs of the low-income group. Our search has been somewhat disappointing in that we have been unable to find many such plans in operation. We are informed that more than 200 plans to provide medical care

are being tried out throughout the country, but there are a much smaller number of similar dental experiments.

Possibly the most outstanding plan in operation at the present time and one which is commanding the attention of the dentists throughout the country is the so-called Washington, D. C. plan. The medical, dental, hospital and community fund have formed a centralized health organization in Washington, D. C., known as the Medical-Economic Security Administration. Mr. Ross Garrett, a doctor of public health, is in charge of the project. The plan is an effort to bring together and coordinate all the health facilities and activities of the city so that the indigent, near-indigent, low-wage worker and those who are temporarily economically embarrassed may be given adequate health care by a service that is controlled by the medical and dental professions. This plan consists of three divisions: a central admitting bureau for hospitals, a medical and dental service bureau and a group hospital service plan. Through the central admitting bureau for hospitals, a clearing house was established that determined the social-economic status of all persons in the District of Columbia who were worthy recipients of free care in the clinics and the free wards of the community private hospitals, as well as the public hospital. The committee claims that, by coordinating existing resources in community hospitals and clinics and by control over the admission of ward and clinic patients of indigent status, a large percentage of the people could be readjusted to assume a goodly share of the economic responsibility for their hospital care themselves, and also that a greater amount of medical service might be provided to those who were worthy and in need.

So successful was the operation of the hospital admitting bureau that a second unit, known as the medical-dental service bureau, was established, last March. The purpose of this bureau was to make it possible for all wage-earning people to secure dental and medical care from the dentist or physician of their choice at a fee they could afford to pay and on a post-payment basis. Persons of low income needing dental or medical service, but who cannot afford to pay for such service in a lump sum are referred by their dentist or physician to the central admitting bureau. Here, they are interrogated by skilful budget advisors, who help them to budget income and expenses so as to make provision for payment of the necessary dental service. The dentist is advised that the patient can budget a certain amount for dental care during the coming twelve months at the rate of so much a month. If the dentist wishes to accept the patient on that basis, the work is started at once. The patient pays the central office so much a week, and this payment, less 10 per cent, is forwarded to the dentist. The bureau retains 10 per cent to cover the costs of overhead and to establish a sinking fund to care for catastrophic cases. The third phase of this plan is a group hospital service plan. Employed persons are, on payment of $9 a year, entitled to twenty-one days' hospitalization, plus the use of hospital facilities, although no medical care is provided.

Exponents of the Washington, D. C., Medical-Economic Security Administration plan expect that their central admitting bureau will have an income the first year of $120,000. During the first six months, they cared for 8,000 patients referred by physicians, dentists and hospitals. Their income during that period was approximately $85,000 and their losses but 1.6 per cent.

So well has this plan been received that

several other communities have installed it in modified form. The medical and dental societies of St. Louis, Mo., have adopted most of the provisions of the plan. The Missouri State Medical Society has recently approved it with the idea of possibly installing it throughout the state. The Essex County Dental Society and the Passaic County Dental Society of New Jersey have adopted this plan with certain modifications. It is claimed that several Texas communities are also about to install it. Whether the Washington, D. C. plan or experiment will be ultimately successful remains to be seen. Its proponents assert that it comes nearer to providing a solution to our problem than compulsory health insurance in that it furnishes the machinery whereby every one, including the indigent, can receive health care—something that compulsory health insurance does not do. On the other hand, advocates of compulsory health insurance assert that it will not solve the problem as effectively as an insurance system. Certainly it is too early to pass an honest opinion at this time. If, at the end of five years, it has proved its worth, it might be wholeheartedly recommended to others.

The medical and dental societies in Indianapolis, Ind., have, within the past year, adopted a plan which is quite similar in many respects to the Washington, D. C. plan. The Medical and Dental Business Bureau, Inc., was established in May, 1934. The business details are handled by an independent business organization. It has the endorsement of the Indianapolis Medical Society and the Indianapolis Dental Society and, it is said, of more than twenty of the larger local industries. Any worthy employe or member of his family who is in need of medical or dental care and who cannot pay cash may be referred to the bureau by the physician or dentist with a note of instruction. The bureau investigates the financial, industrial, economic and marital status of the applicant. If the case is found worthy, arrangements are made to provide the necessary care. The doctor sends an estimate of the cost to the bureau and the bureau arranges with the patient a definite plan of liquidation in small installments, coordinating it with his income and ability to pay over a period not to exceed twelve months (except in very special cases). The bureau deducts 10 per cent of the bill to cover expenses. All members of the Indianapolis Medical and Indianapolis Dental societies are automatically members of this bureau and can utilize its services.

Recently, the Indianapolis Dental Society has incorporated in their plan some aspects of the Chicago Dental Society's Industrial Diagnostic Service plan, with certain modifications. Through the medium of a committee known as the Dental Diagnostic Service Board, employers are informed of the purpose and operation of the diagnostic service. If the employer agrees to the plan, the society sends a speaker to the plant and, in due time, one or more examiners. The employes are classified according to income by the employers; which helps in determining the type of dental service to be recommended. Patients are referred only to dentists who are members of the association. Should the employe be unable to pay cash for the necessary service, he is referred through the Medical and Dental Business Bureau for post-payment service.

Last October, the Omaha-Douglas County Medical Society and the Omaha-Douglas County Dental Society inaugurated a health service plan known as the Omaha-Douglas County Health Service. This plan is quite similar to the Washington, D. C. plan and the Indianapolis plan. An executive secretary is

employed to interrogate prospective patients and to help them budget their income and expenses in order that they may meet their medical and dental bills on a deferred payment basis. Patients may be referred to the central health service office by a social agency or a physician or dentist, or may come in of their own accord. If the applicant requires dental service and has a very small income and no family dentist, the executive secretary, after he has satisfied himself that this is a bona fide case, gives the applicant a list of the members of the Omaha-Douglas County Dental Society. The applicant chooses a dentist from that list and the executive secretary calls the dentist and explains the situation. If the dentist accepts the case, he estimates his fee according to the patient's known income and expenses. This statement of fees is sent to the central health service office, where some further adjustment may be necessary before the case may be continued. When a satisfactory arrangement is made, the health service office collects the fees from the patient on a prearranged schedule and remits the payments, less 10 per cent, which is deducted for overhead, to the dentist. If medical and hospital, nursing or pharmaceutic service is also needed, a proportion of the weekly payment goes to each. If possible, payments are confined to a ten-month basis. A year is considered an undesirable maximum. Drugs are furnished on a cost plus 10 per cent basis by the Omaha Retail Druggist Association. All ethical physicians and dentists are free to utilize the service whether they are members of their respective societies or not. This is a medium whereby low income families are afforded medical and dental care at a rate compatible with their income.

Time will not permit a description of all the plans and experiments now in operation or contemplated in an effort to solve the problem of health service to the low income group. Nor has any one plan been in operation a sufficient length of time to prove its efficacy. A study of all existing plans that we have encountered led the Committee on Economics to present a resolution on the subject to the House of Delegates of the American Dental Association last November. The resolution, passed by the House of Delegates, reads:

Resolved, that the American Dental Association in Annual Session assembled approve of further study and experimentation with plans to furnish such services as have been established in Washington, D. C., and St. Louis, Mo., as we believe that the outcome of such practical research might terminate in a satisfactory solution to the vexing problems of providing adequate dental service to the low income group.

PHASES OF A COMMUNITY DENTAL CREDIT BUREAU*

By H. D. MEYER, D.D.S., Evanston, Ill.

IT is with considerable reluctance that I have agreed to submit and discuss a plan for a professional credit bureau. Many such bureaus are already functioning, and each must be so framed as to meet the demands made on it.

Credit bureaus are no innovation. Successful ones should be more numerous. I am familiar with such an undertaking through intimate association with it, and I must confess that its success is possible because we are actually giving away a service to the membership. In our effort to be businesslike in our credit opinions, we are most unbusinesslike in the financing of the undertaking. "Penny wise and pound foolish," you see.

Perhaps the admission in the foregoing statement will tend to make you doubt the wisdom of what is to follow, but the principle is sound and the method is workable, as has been proved. The difficulty seems to be the profound individualistic tendency which the dentist-subscriber exhibits. This is decidedly a collective effort and cannot succeed otherwise.

Credit bureaus are of two distinct types, the most effective and elaborate one being the "current" or up to the minute types. These receive reports on all financial experiences in the case of retail trade, and our financial experience with patients is of a retail nature.

To develop this type of bureau would mean that all patients would be reported on and classified according to their paying habits. It is my opinion that this type of bureau is to be avoided when a dental credit bureau is to be established.

Then, there is the other type known as a "derogatory bureau." The information on file in this case is of a negative sort. Only when an account gets into dangerous territory, that is, beyond the bounds of good business practice, does this information become available to subscribers to such a service. This, it seems, is the type most applicable to the practice of dentistry.

Next, we should consider a few common terms that are used; namely, "credit facts," "credit opinion" and "credit granting."

Credit facts are, as the name implies, the paying habits of the debtor in the account being considered. In other words, what has the creditor's experience been in the collection of the account? It is well to note, at this point, that this is the only information which a derogatory bureau should be interested in.

Credit opinion is based on credit facts, and again, as the name implies, it is strictly a personal opinion as to the responsibility of the debtor with respect to his ability to pay.

Credit granting is the treatment of the case under consideration, and is the conclusion as to how much credit you will extend, and what your terms will be.

Before a plan that I believe would be

*Read before the Section on Dental Economics at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 20, 1936.

workable and practical for a community credit bureau is suggested, it would be well to point out some of the abuses of professional credit granting, as well as a few facts concerning mercantile credit experience.

In the mercantile world, 85 per cent of all business is done on a credit basis. That being the case, along with the fact that margins of profit are much smaller than we as professional people can afford and do realize, it is apparent that more care must be used in extending credit in this field. As an example, may I submit a few figures, taken from authentic sources, that will afford some idea of the credit losses in the mercantile field.

In a survey made by the Department of Commerce, it was found that bad debt losses for miscellaneous retail establishments vary from 0.2 per cent to over 5 per cent. Why should there be this wide variation, with some showing losses 25 times those of others? Further investigation shows that losses of credit bureau users ranged from 0.2 to 1.3 per cent; while that of nonusers varied from 2.1 to over 5 per cent.

Now, as to the abuses of credit in the professional field, which, after all, is the subject in which we are interested and which can be controlled in large measure through the establishment and use of a community credit bureau:

We are all familiar with the so-called "joy-rider"; the man who employs more than one dentist and owes all of them. Incidentally, this type of abuse can be completely stopped through the use of a credit bureau. It is not at all uncommon to find accounts owing from two to five dentists.

Then there is the person who pays all of his current bills except the professional ones. He may not need the services of his dentist again for six months or a year and therefore decides to defer payment until that time. If it is still inconvenient to pay at that time, he may decide to try another dentist. Again, the credit bureau comes into action and serves the dual purpose of bringing about a collection and keeping your patient as well.

There are those who are just naturally slow to pay. It seems to me that they will always be with us, but it is a help to know that such is the case.

Lastly, there are those who pay their bills through claiming that the work is unsatisfactory and thereby effect a settlement. They may resort to litigation, or they may resort to bankruptcy and thereby wipe the slate clean. It is well to have access to the method of settlement in such cases as these, since they cannot be considered as an account paid in full.

Bear in mind that I have no intention of telling you how to manage your credit business; neither do I intend to suggest a method of determining credit limits or credit risks. It is possible to assemble certain credit facts, and may I emphasize the word facts as directly opposed to the word opinion. These facts, properly assembled and offered to the member of a good credit bureau, are of tremendous value in arriving at one's opinion in credit granting. So much for the need of a credit bureau, and now for the plan itself.

First, it must be determined by the membership of the proposed bureau what they consider terms of satisfaction in the payment of professional accounts. The rule must be definite and all members must abide by it. I would suggest that only such accounts as have become 90 days old be considered, except those in which some deferred payment plan has been arranged. Immediately on default of a deferred payment, these too must be considered.

With this class of accounts to work

with, and it will be larger than you will like to admit, it is apparent that the largest task is to assemble and file the accounts of the responsible or should I say irresponsible persons involved. We must know the correct name in full, the address, the telephone number, the date the account is turned into the bureau and the identity of the doctor giving the information. You will note that nothing has been said as to the amount owed. It seems to me that the amount is irrelevant at that time.

This information is placed on a standard filing card and can be sent to the bureau every thirty days, or, better still, a representative from the bureau can call on all members and collect the information desired. At this same call, he will be expected to pick up data on all accounts previously turned into the bureau and which have been paid or otherwise settled in the past thirty days.

If I have made clear the kind of information which this type of bureau desires, you will immediately see that it is all of a negative nature. It in no way alters the credit rating of the person under consideration, but it does stop the flagrant credit abuses which have been previously mentioned. This type of credit information builds what is termed a "derogatory credit bureau," and it is interesting to know that it is just such a bureau that exists in the retail trade in the city of Chicago.

Of course, the ideal would be a bureau that contained information on all persons seeking professional service, but this procedure entails an elaborate office and a cost to the membership that would be prohibitive to many. May I emphasize right here that a large active membership, embracing as large a number of the dentists in the community as is possible, is most necessary in order to assemble information that is sufficiently far-reaching. The value of such an organization is in that same proportion.

Now as to the clearing of accounts that the bureau has filed in its open accounts file: When such an account has been paid in full, a new card is set up and filed under "closed accounts." It would be well to use a blue card in this case, and for the accounts that have been closed or paid through settlement or otherwise, it would be well to use a red card. Of course, the original open account filing card is destroyed, so that all that remains is the evidence that this has not been a satisfactory account, and we can also find out just how unsatisfactory, if we so desire.

The picture is now complete. There is a constant flow of ninety-day accounts into the bureau office. There is likewise, or should be, a flow of closed accounts either of the "blue" or "red" type, all of which are filed in their proper places. The information is there for the asking. The member can at least extend credit to his new patients with his eyes open, so to speak.

Further, there is a legal aspect to the entire undertaking. A very nice reciprocal relationship with other credit bureaus can be worked out. Also, there are collection possibilities in connection with such an undertaking, all of which depend on the foresight of the membership in general.

In conclusion, let me say that the success of the bureau, like that of all collective efforts, will be in proportion to the cooperation of its membership. They should abide by the judgment of whomever they choose to lead the undertaking, and they should fully realize their own responsibility. "Joy-riding" will be stopped. Persons who are slow to pay will be so denominated. Accounts that are paid through settlement or through litigation will always be known as such.

Last, but not least, the very knowledge that there is in existence such an exchange of credit information will, in many cases, prompt a debtor to pay a bill that might otherwise become delinquent.

The complete details of this plan have not been given. I have preferred to mention only the salient points, since, after all, the details should and must be worked out by the organization about to undertake the establishment of a community dental credit bureau.

"RESOLUTIONS AREN'T ENOUGH"

The May, 1936, issue of *Medical Economics* carries an interesting article by I. Weston Walch, who compiled the "Handbook on State Medicine" used by many students during the past winter who debated the topic: "Resolved, that the several states should enact legislation providing for a system of complete medical service available to all citizens at public expense."

Says Mr. Walch: "The fact that most successful private physicians are against socialized medicine is not news. . . . Nor is it news that most college professors of sociology strongly favor greater state participation in medical affairs. Such men are altruistic; they have no practical experience. Debating coaches, however, must train teams to defend both sides of the question. They must be broad minded. If after a season's study of the question of socialized medicine, a majority of debating coaches should become convinced that one side of the question was right while the other was wrong that would be news."

No one knows definitely whether the majority of coaches have reached a definite conclusion. In correspondence and personal interviews, Mr. Walch states: "Not a single coach has claimed that the state medicine question is unbalanced in the affirmative, dozens of them have expressed the personal opinion that the negative (antistate medicine) is the much easier side on which to build a strong case. . . . You should hear some of the queer plans of state medicine I have been listening to recently. They all show that the coaches behind these teams do not believe in state medicine."

Many coaches are concerned, first, over the political and bureaucratic interference that would follow socialization and, secondly, over the almost unbearable cost, which would have to be met by some form of increased taxation. Debate coaches, being teachers, know what public ownership and operation have meant for the schools. They would not advocate the abolition of public schools because there is nothing satisfactory to take their place, but they see no need of public medicine with private medicine already a working, efficient organization.

Under socialized medicine, our 160,000 doctors would become political job holders, but getting a job would not be all. Like present day teachers, doctors would be at the mercy of political manipulation as regards their salaries. Depressions and tax revolts would reduce the doctors' salaries just as, during recent years, the schoolteachers', policemen's and firemen's salaries were reduced. Coaches are aware of the demoralizing effects of facing payless pay-days, overcrowding of classes and using tattered textbooks, and they realize that medical service, under similar conditions, would not be worth much.

"Furthermore," says Mr. Walch, "debating coaches are aware that the people are not in a mood to favor anything that means increased taxation. Our governments—national, state and local—are now raising, through taxation, a sum equal to $300 for every family in the United States each year. At the same time our governments are spending $450 per family per year, leaving a sum equal to $150 per family to be charged up each year for future generations to pay. Sometime, somehow, we must meet our government expenses out of taxes and pay back our debts. Unless drastic retrenchment takes place, it will require a yearly taxation of 35 cents out of every dollar earned by every American. In other words, a wage earner getting $14.00 a week is going to lose $4.90 a week through

indirect taxes. Even the average highschool student sees the weakness of this spending policy. Spending such a large proportion of income for taxes leaves nothing for nourishing food and decent living quarters. The resultant slum conditions and malnutrition lead to disease, unemployment and the need for further government taxation. The cycle goes round and round."

In conclusion, Mr. Walch says: "The case against state medicine is strong enough if only the medical profession generally would bring it to the attention of the general public. . . . The public must be continually reminded of the real facts and dangers of public encroachment on private medicine."

Last winter's debates should give medical men renewed courage. Despite all the statistics of those favoring socialization, the preponderance of argument has shown itself to be on the doctor's side. The situation calls for renewed vigor in the war against the propaganda of those favoring socialization.

CURRENT LITERATURE

Stomatitis Due to Sensitization to Dental Plates (Herbert Rattner, J.A.M.A. 106, 2232 [June 27] 1936): Three case histories illustrate what is apparently an irritant stomatitis arising in suceptible persons from sensitization to materials in dental plates. One patient, a woman, aged 60, had worn full upper and lower vulcanite dentures for years. Three years ago, she had new dentures (made of a substance said to be hecolite), which were comfortable for three months. Then there developed a burning of the tongue, a peculiar salty taste, increased salivation and, finally, a diffuse inflammatory reaction of the entire oral cavity. The only indication that she had given of allergic disease was an urticaria, occurring one time. Her family had been free of such manifestations. The sequence of symptoms beginning shortly after the wearing of a new denture suggested that the patient might be sensitive to something in the plates, especially since there were no other phenomena (either medical or mechanical) to account for the symptoms. A "patch test" was made by strapping the plate to the inner surface of the arm. Forty-eight hours later, there was an area of vesicular dermatitis on the site, which was a mirror image of the plate in size and shape. Strapping the plate to the skin of two other persons produced no reaction. Within one week after the patient stopped wearing the plates, there was a striking improvement. Of the two other cases cited, one gave a positive patch reaction. Soreness of the mouth is probably due to a combination of factors. The plate resting on the mucous membrane acts as a foreign body, which mechanically irritates the mucous membrane. There is, as a result, abnormality in the circulation of the mucous membrane, and its secretions. Also, the plates are not self-cleansing, are poor conductors of heat and are often porous and possibly contain injurious chemicals. The author adds that soreness of the mouth may be due to a sensitization to materials in the plates.

M. K. HINE.

Preventive and Prophylactic Value of Heliotherapy in Practice of Children's Dentistry (I. G. Woodcock, M. Woman's J., 43:183 [July] 1936): Heliotherapy, from the sun or artificial source, has three properties that render it useful in periodontic treatment: It increases tissue resistance, relieves pain and improves metabolism. In dental caries, adequate diet and hygienic oral care may be offset by lack of sunshine, with resultant poor calcification. Rural children are often deprived of a balanced diet and city children fail to receive normal doses of sunlight. The situation is analo-

gous with the problem in rickets. To prevent dental caries, the child and expectant mother must receive the proper diet, oral health must be maintained and normal sunlight must be available. In selected cases, the author recommends treatment of fistulas of deciduous teeth by quartz ray to save the space retainers. The value of heliotherapy in peridental inflammation and oral trauma is pointed out. The painless application of heat and light is, the author believes, of psychologic value in pediodontia. Attention is drawn to the need for further investigation in the field of oral heliotherapy.

HAMILTON ROBINSON.

Extragenital Lesions of Lymphogranuloma Inguinale (V. C. David and M. Loring, J.A.M.A., 106:1875 [May 30] 1936): Four case histories of extragenital lesions of lymphogranuloma inguinale are presented, one of these describing a patient in whom a large ulcer appeared in the floor of the mouth and at the base of the tongue. The only etiologic factor in this case was the possibility that a slight cut was received when the patient licked several envelops. The submaxillary, submental and supraclavicular glands became swollen, and severe headaches, chills and a fever of 103 F. developed. The patient had lost 15 pounds, was pale and the speech was thick. The general examination and Wassermann and Kahn tests were negative.

In the mouth was a flat ulcer 4 by 3 cm., with raised edges and a foul base, covered with a thick purulent exudate. The lesion was indurated and only slightly tender. Both submaxillary regions were markedly swollen, reddened and fluctuant, and subsequently broke down. Cultures of pus from the glands were sterile. Biopsy material from the ulcer showed chronic inflammatory tissue without tubercle formation or giant cells. The Frei test was positive with five different antigens. An antigen prepared from pus from the neck gave a positive Frei reaction in five cases of known lymphogranuloma inguinale. This established the diagnosis as extragenital lymphogranuloma inguinale. Injections of antimony and potassium tartrate were given intravenously. Later, fuadin was injected intramuscularly for two weeks, with a two-weeks free interval. The ulcer slowly healed, and the general health of the patient returned to normal. The authors emphasize the importance of contact infection in lymphogranuloma inguinale, which may lead to serious lesions in the colon or the mouth.

M. K. HINE.

Denicotinized Cigars and Cigarets (J.A.M.A., 107:58 [July 4] 1936): A physician from Massachusetts asks questions concerning denicotinized cigars and cigarets that are answered as follows under "Queries and Minor Notes":

"Benefit from the use of so-called denicotinized cigarets or cigars, instead of the ordinary brands, depends on the relative amount of tobacco so consumed. The various brands of so-called denicotinized tobaccos so far examined have been found to contain from 0.5 to 1 per cent of nicotine by weight, as compared with an average of 0.8 per cent for West Indian cigarets, 1.5 per cent for Oriental brands, 2 per cent for the common blends, which constitute the bulk of popular consumption, and 2.5 per cent for the straight domestic brands. It appears that the special processing to which such tobaccos have been subjected removes a considerable part of the nicotine originally present but that they are generally composed of high nicotine containing tobaccos to begin with, so that the residual nicotine present may still be much higher than that of certain brands of cigarets not so treated.

"The amount of nicotine actually absorbed depends not only on the nicotine content of the tobacco used but also on the amount of such tobacco consumed and the manner in which it is smoked. If the smoker relies on the advertised claims and increases either the number of cigarets smoked, the length of cigaret consumed or the size of cigaret or cigar used, he may suffer from an actual increase in the amount of nicotine absorbed. Inhaling the smoke also appreciably increases the amount of absorption of smoke constituents. If the higher cost of the specially treated cigarets induces

the smoker to economize in their use, he may indirectly benefit from the lessening in the actual amount of tobacco used.

"Nicotine itself is held responsible for the production of extrasystoles and other cardiac arrhythmias, the development of "tobacco amblyopia" and the aggravation of thrombo-angiitis obliterans or other circulatory disturbances. Other constituents of the tobacco smoke must be responsible for the local irritation of the mucous membranes of the nasopharynx, the conjunctiva and the larynx, leukoplakias of the buccal mucosa and cancers of the lower lip, as well as for the allergic manifestations that have been described. The carbon monoxide content of cigaret smoke is usually too low to produce clinical symptoms, although occasionally it may play a part in the production of headaches."

M. K. HINE.

Adamantinoma of Jaw of Rabbit (J. W. Orr, J. Path. & Bacteriol., 42:703 [May] 1936): Spontaneous epithelial tumors are apparently unreported in rabbits. In a female rabbit, approximately 3 years old, a 4.1 by 3.4 by 2 cm. enlargement was noted at the posterior aspect of the left mandible. On section, it showed two large mucoid-containing cysts. The surrounding bone was fragile and spongy, but the alveoli and teeth were not involved except that the soft tissue was distorted by the bony changes. Microscopically, the cysts showed a lining of stratified squamous epithelium without keratinization and elsewhere solid alveolar masses of squamous cells were seen. No relation to earlier experimental treatment was apparent. (In the opinion of the reviewer, this tumor does not represent an adamantinoma, but as this opinion is based on a study of the photomicrographs and the description only, no positive statement can be made.)

HAMILTON ROBINSON.

Roentgenologic and Anatomic Study of Maxillary Sinus (Oscar V. Batson and Leroy M. Ennis, Am. J. Roentgenol., 35:586 [May] 1936): There are many anatomic changes of the maxillary sinus during the life span of the individual. The sinus is present at birth, although quite small, lying in the maxilla, together with the unerupted tooth buds. When dentition is progressing normally, the sinus is expanded from its infra-orbital position to the level of the attachment of the inferior nasal turbinate. Its floor is opposite the middle nasal meatus. At puberty, or with the eruption of the teeth, the maxillary sinus has expanded to the level of the floor of the nose. It continues to expand, and often its lowest portion is below the level of the floor of the nose. Further change is noted after the loss of the teeth, and the recession of the alveolar ridge. The maxillary sinus ascends at the time of edentulous senility until it is again at the level of the floor of the nose. There are often many other recognized extensions or diverticula enumerated by Zuckerkandi, such as infra-orbital, zygomatic and palatal. The author adds a most important one that is being overlooked: the tuberosity extension. Preparing a mouth for full dentures and the surgical reduction of the bony prominences often has led to the opening of the sinus at the tuberosity. A roentgen investigation before surgical procedure would prevent this. The authors strongly advise the use of intraoral films for practically all maxillary sinus investigations, to eliminate complications by the overlapping of the dental shadows.

J. FRANK HALL.

Study of Diet in Relation to Dental Caries Activity in 212 Enlisted Men at Pearl Harbor Submarine Base, Hawaii (Martha R. Jones and George N. Crosland, U. S. Nav. M. Bull., 24:181, 1936): In a group of 212 enlisted men at the Submarine Base, United States Navy, at Pearl Harbor, Hawaii, an increase in dental caries was noted. Investigation disclosed that the increase in caries did not parallel age, but did parallel time of service in Hawaii. The percentage increases in total defects per man was 23.52, 30.06 and 39.97 per cent for those who had been in Hawaii from six to twelve months, one to two years and two to five years, respectively. The authors found that the diet consumed furnished 3,613 calories, 136.78 gm. of protein; 418.11 gm. of carbohydrates; 154.95 gm. of fat; 0.844 gm. of

calcium; 1.943 gm. of phosphorus; 0.027 gm. of iron; 18.8 c.c. of excess normal alkali; 8,047.9 standard rat units of vitamin A, and 219.1 standard units of vitamin C. A daily average of seven and one-half hours of tropical sunshine furnished vitamin D. They believe this diet would score as excellent if valued by accepted standards. The authors suggest that, in view of the dental results attained by dietary changes for children in Hawaii, had the diet yielded 80 c.c. excess normal alkali the incidence of caries might not have been so great. Changes in the navy ration to increase its potential alkalinity were recommended at a decrease in cost. The dangers of a diet too definitely alkaline as possibly resulting in alveolar resorption were noted.

H. E. Harvey.

Cavernous Sinus Thrombosis (J. B. Cavenagh, Brit. M. J., 3936:195 [June 13] 1936): Thrombophlebitis of the cavernous sinus is generally considered a rare but fatal condition. The first mention of cavernous sinus thrombosis was made in 1818 by Abercrombie, who described the condition from a postmortem finding. The first clinical diagnosis was made by Vigla in 1839. Dwight and Germain were the first to attack the sinus surgically. The author classifies the cases according to their type and mode of onset as acute fulminating and chronic compensatory. The treatment is classified under (1) major surgical measures, directed at the cavernous sinus itself; (2) accessory surgical measures, dealing with the primary source of infection and draining of the formed abscess, and (3) serotherapy, blood transfusions, etc. Spontaneous recovery sometimes occurs in the absence of any form of treatment. Twelve cases are reported in this article. The one probably of most interest to the dental profession was reported by Christophe in 1928. A woman, aged 32, after three months of gradually increasing pain from a filled right upper bicuspid, began to have a high temperature and lost the sight of the right eye. This was followed by exophthalmos, extreme chemosis and limitation of movement. Examination of the fundus was impossible owing to extravasation of blood. The eye was not removed. A roentgenogram revealed an abscess at the apex of the bicuspid, which was extracted. The patient made a complete recovery.

J. Frank Hall.

Influence of Heredity on Systolic Blood Pressure (V. Augustin, Brit. M. J., 3934: 1142 [May 30] 1936): In 8,805 cases at the University Hospital of Budapest, patients were questioned as to the cause of death of their parents, and their age at death. It was noted that offsprings of parents dying from such diseases as hemorrhage of the brain, cardiac paralysis, arteriosclerosis, diabetes and diseases of the kidneys, had a comparatively high blood pressure. In patients whose parents had died from tuberculosis or intestinal disturbances, blood pressure was comparatively low. The author points out that heredity should be considered a factor in determination of the significance of blood pressure.

J. Frank Hall.

Treatment of Fusospirillary Infection of Gums (C. Bowdler Henry, Brit. M. J., 3934:1104 [May 30] 1936): As agranulocytosis is exciting much interest, it may be opportune to draw attention to an etiologic factor which is commonly present in the anginal form; namely, the fusospirillary symbiosis, or Vincent's infection. Three features of the disease are worthy of emphasis: 1. The way it persists in a subacute or chronic form after an acute attack, and leads at times to remote secondary lesions. (Goodby relates a fatal case of sudden fusospirillary empyema in a robust man eighteen months after an attack of Vincent's stomatitis.) 2. The ability to gain an insidious entrance to the gingival tissues, so that a widespread and painless infection involving all the teeth is well established before any symptoms appear. 3 Predisposition, like that of recurrent agranulocytosis, to intermittent fulmination in the mouth and fauces, following periods of quiescence which sometimes last many months. The author explains the diagnosis, including the bacteriologic examination, and the technic

of his treatment for the acute, subacute and chronic stages. Four cases are given in detail.

J. FRANK HALL.

A Tour of American Dental Schools (E. Matthews, Brit. D. J., 60:219 [March 2] 1936): The author records his impressions of his visits to this country. Among the schools visited were: Temple University, University of Pennsylvania, Western Reserve, Indiana, Chicago College of Dental Surgery, University of Illinois, Northwestern University, University of Minnesota, University of Michigan, Toronto University, University of Rochester and Columbia University, as well as the Bureau of Standards. Frank opinions are given about each of the dental schools. The author was greatly impressed by the amount of research in progress, the equipment of the schools and fees paid by patients at dental school clinics and the small percentage of the total population receiving dental care.

HAMILTON ROBINSON.

Treatment of Fibrositis (W. S. C. Copeman, Brit. M. J., 3936:1219 [June 3] 1936): Fibrositis is a condition in which inflammatory changes involve the subcutaneous tissues, the superficial or deep fascia of the body, the muscle sheaths and tendons, the fibrous portions of the joint capsules and ligaments, the bursae or the fibrous sheaths of the larger nerves. The author classifies the condition under (1) panniculitis, inflammation of the subcutaneous tissue and fat; (2) myositis, inflammation of the superficial and deep fascia and muscle sheaths and tendons, and (3) neuritis, inflammation affecting primarily the fibrous sheaths of nerves. The clinical manifestations vary according to the area of the body and the type of fibrous tissue involved. Attacks of fibrositis occur in many people without apparent detriment to their general health, and, in such persons, the suspicion must arise that the cause may not be primarily an infective one. The general principle to be adopted in the presence of any case in which the symptoms do not call for urgent treatment will be an endeavor to establish the etiology of the attack. A large group of cases can be traced to the presence of local infection. The teeth and tonsils are generally suspected, especially when the upper part of the body or arms are chiefly affected. It must be remembered, in this connection, that the lack of evidence roentgenographically of apical infection of the teeth must never be accepted as conclusive that this does not exist, since changes that can be demonstrated by this means are necessarily chronic and advanced.

J. FRANK HALL.

MISCELLANY

BOOK REVIEW

An Elementary Manual of Physiology: By Russell Burton-Opitz, S.M., M.D., Ph.D., Consulting Cardiologist, Lenox Hill Hospital, New York; Consulting Physician, Cumberland Hospital, Brooklyn; Consulting Cardiologist, Englewood, North Hudson, Hackensack, Holy Name and Christ Hospital, New Jersey; Lecturer in Physiology, Columbia University and Savage School of Physical Education. Fifth Edition, revised. 442 pages with 152 illustrations. Philadelphia and London: W. B. Saunders Company, 1936. Cloth, $2.50.

According to the preface of this, the fifth edition, the purpose of the book is to acquaint the reader with the rudimentary facts of physiology, and therefore all controversial material has been omitted. The book is intended for use in colleges and schools of nursing, of physical education and of "the practical arts." In spite of the fact that an effort has been made to simplify the subject matter and rob it of its complexity, 442 pages are covered with closely packed type. The author believes that this

book will answer the needs of those who must meet the demands of certain states as regards elementary courses in physiology for license to teach in secondary schools and high schools; and, in turn, with properly trained teachers, the interest of the elementary school pupil in the subject will be aroused. In response to the criticism that former editions omitted the subject of reproduction, a brief chapter covering the topic with as little detail as possible has been added. Several statements under this subject are not in accord with commonly accepted theories or the latest research. Although the mode of expression ranges from that suitable to the child of early teen age to that suitable to the informed adult, the language is at all times clear and the thought easily followed. There is a tendency to employ the older spellings, as in "dyspnoea," and the germanic "bloodsupply," "bloodvessels," "bloodflow," etc. As evidence of the breadth of the subject matter, chapters are presented on living matter, general phenomena and conditions of life, motion, structure and general behavior of muscle tissue, contraction of muscle, chemistry of muscle, nerve impulse and reflex action, the lymph, the blood, the circulatory system, the heart, flow of blood, blood pressure and related phenomena, nervous control of heart and blood vessels, the lung, mechanics and chemistry of respiration, nervous regulation of respiration, salivary, gastric and intestinal digestion, absorption of food, metabolism, excretion, the internal secretions, development of the nervous system, the brain, the five senses, the eye and reproduction.

The book is of very convenient size and printed on well finished paper. Many of the numerous illustrations are in color.

K.

NEWS

New York State Society Elects Officers: At the last yearly meeting of the Dental Society of the State of New York, the following were elected officers for the ensuing year: president, D. Austin Sniffen, White Plains; president elect, Edwin I. Harrington, Watertown; vice president, Russell W. Tench, New York City; secretary, Charles A. Wilkie, New York City; secretary-emeritus, A. P. Burkhart, Auburn; treasurer, George H. Butler, Skaneateles.

Dr. Henshaw Honored: Frederic Rich Henshaw, for twenty-two years dean of the Indiana University Dental School, and newly appointed director of the Children's Dental Clinic, Indianapolis, has been honored by Wabash College with the degree of doctor of science.

DEATHS

Anger, H. E., Brooklyn, Iowa; died April 26; aged 72.

Bailey, Charles F., Philadelphia, Pa.; University of Pennsylvania College of Dentistry, 1904; died June 24.

Barlow, Milton I., Kansas City, Kan.; Kansas City-Western Dental College, 1919; died recently; aged 43.

Burg, Robert A., Milwaukee, Wis.; died May 31, aged 52.

Darracott, S. B., Marksville, La.; Tulane University of Louisiana, School of Dentistry, 1915; died June 11, after an illness of several months; aged 42.

Drummond, R. Lee, Kansas City, Mo.; University of Louisville, School of Dentistry, 1899; died recently; aged 70.

Eccles, Friend R., Chicago, Ill.; Chicago College of Dental Surgery, 1905; died June 24.

Gieseler, Arthur W., Milwaukee, Wis.; died May 16.

Gramm, Carl T., Chicago, Ill.; died June 30; aged 74.

Kuesel, Mary H. Stillwell, Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1888; died June 22.

Leigh, Joseph F., Evanston, Ill.; State University of Iowa, College of Dentistry, 1891; died June 18.

McCreight, Glen H., Greenfield, Iowa; State University of Iowa, College of Dentistry, 1915; died April 15; aged 43.

Osborn, Amos E., La Porte, Iowa; State University of Iowa, College of Dentistry, 1891; died May 25; aged 70.

Ripperda, George, Larchwood, Iowa; Creighton University College of Dentistry, 1928; died May 31.

Vaughan, R. R., St. Louis, Mo.; Balti-

more College of Dental Surgery, University of Maryland, 1884; died June 20; aged 80.

Walsh, William Henry, Chicago, Ill.; Northwestern University Dental School, 1901; died June 12; aged 61.

Whitmer, Gale, Chicago, Ill.; died recently; aged 30.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Atlantic City, N. J.

American Society of Orthodontists, Chicago, April 26-29.

Chicago Dental Society, February 15-18.

Greater New York Meeting, December 7-11.

New York Society of Dental History and Culture, New York City, October 15.

Texas-Oklahoma-Dallas County, Dallas, August 31-September 4.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

Great Lakes Association of Orthodontists, Toronto, Canada, October 19-20.

Montreal Dental Club and Canadian Dental Association, Montreal, October 14-16.

American Congress of Physical Therapy, New York City, September 7-11.

STATE SOCIETIES

August

Texas, at Dallas (31-September 4)

September

Southern California, at Los Angeles (21-23)

October

Florida, at Orlando (5-7)

November

Puerto Rico, at Mayaguez

May

Illinois, at Springfield (11-13)

New York, at New York City (11-14)

STATE BOARDS OF DENTAL EXAMINERS

Arizona, at Flagstaff, August 3. R. A. McCall, 719 Professional Bldg., Phoenix, Secretary.

Iowa, at Iowa City, December 14-18; May 31-June 4. Hardy F. Pool, Mason City, Secretary.

New Jersey, at Trenton, December 7-12. State Board of Registration and Examination in Dentistry, 148 W. State St., Trenton.

DENTAL SOCIETY OF THE STATE OF NEW YORK

The sixty-ninth annual meeting of the Dental Society of the State of New York will be held at the Waldorf-Astoria, May 11-14.

CHARLES A. WILKIE, *Secretary,*
233 Bible House,
New York City.

IOWA STATE BOARD OF DENTAL EXAMINERS

The next two examinations to be held by the Iowa State Board of Dental Examiners will be given December 14-18 and May 31-June 4, at the University of Iowa College of Dentistry, Iowa City. Credentials must be presented to the State Department of Health, Des Moines, at least fifteen days prior to the date of the examination.

HARDY F. POOL, *Secretary,*
Mason City.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

AMERICAN SOCIETY OF ORTHODONTISTS

The thirty-fifth annual meeting of the American Society of Orthodontists will be held in Chicago, April 26-29, at the Edgewater Beach Hotel.

CLAUDE R. WOOD, *Secretary,*
608 Medical Arts Bldg.,
Knoxville, Tenn.

CHICAGO DENTAL SOCIETY MIDWINTER CLINIC

The Chicago Dental Society announces that its 1937 annual Midwinter Clinic will be held at the Stevens Hotel, February 15-18. Full particulars pertaining to the meeting will be available in the September and subsequent issues of the dental publications.

WILLIS J. BRAY, *Secretary.*

GREATER NEW YORK DECEMBER MEETING

The Twelfth Greater New York December Meeting will be held December 7-11 at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS,
Press and Publication,
Room 106,
Hotel Pennsylvania.

WHEELING DISTRICT DENTAL SOCIETY

The Wheeling District Dental Society (West Virginia) will honor Dr. S. P. Hullihen, a distinguished dentist of 100 years ago, and recently accorded the title "Father of Oral Surgery," at its centennial celebration, August 18. Dentists of surrounding states are particularly urged to attend.

HULLIHEN COMMITTEE.

NEW YORK SOCIETY OF DENTAL HISTORY AND CULTURE

For those interested in the history of the profession and its cultural background, the New York Society of Dental History and Culture will offer for its first meeting of the 1936-1937 season, October 15, "An Evening with John Hunter," a symposium of papers relating to the various Hunterian activities in dentistry, in the auditorium of the Squibb Building, Fifty-Eighth St. and Fifth Ave., New York City, at 8:15 p.m. An exhibit of the works of John Hunter, and photographs and other data relating to his activities in dentistry will be held at the New York Academy of Medicine, October 5-15. All persons affiliated with the dental profession and their friends are welcome to the meetings of the society. Address all communications to

WALTER H. JACOBS, *Secretary,*
124 West Ninety-Third St.,
New York City.

AMERICAN CONGRESS OF PHYSICAL THERAPY

The fifteenth annual clinical and scientific session of the American Congress of Physical Therapy, will be held September 7, 8, 9, 10 and 11, at the Waldorf-Astoria, New York City. Physicians and their technical assistants and nurses working in institutional departments of physical therapy are urged to attend this important session. There will be no registration fee.

AMERICAN SOCIETY FOR THE ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY

The next meeting of the American Society for the Advancement of General Anesthesia in Dentistry will be held October 26 at the Hotel Montclair, New York City.

H. J. FIELD, *Secretary,*
130 Market St.,
Newark, N. J.

GREAT LAKES ASSOCIATION OF ORTHODONTISTS

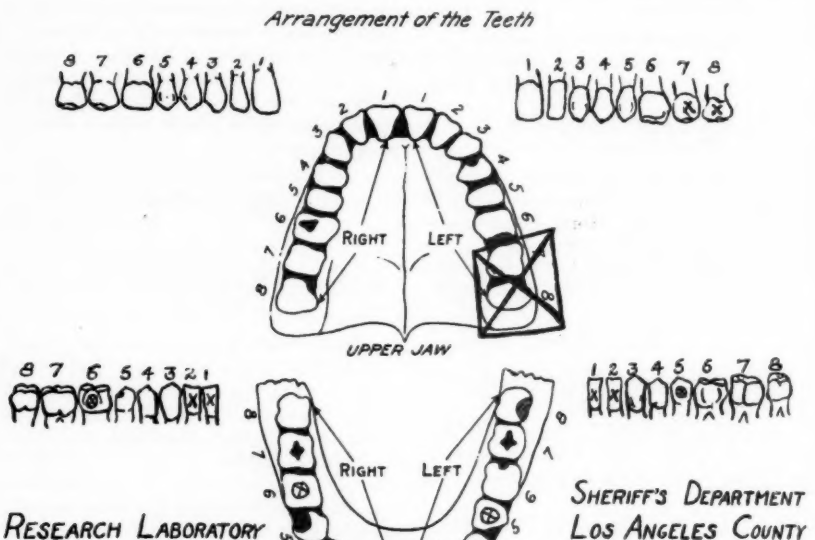
The tenth annual meeting of the Great Lakes Association of Orthodontists will be held at the Royal York Hotel, Toronto, Canada, October 19-20.

S. STUART CROUCH, *Secretary,*
86 Bloor St. W.,
Toronto, Canada.

IDENTIFICATION OF MURDER VICTIM SOUGHT

The office of the sheriff of the County of Los Angeles, California, is endeavoring to solve a murder wherein the solution depends on the identification of the victim.

Only a few of the bones were found, including the mandible and maxilla. Consequently, the only hope of identification rests on the teeth. The chart of the teeth is published herewith with the request that JOURNAL readers make a comparison with charts in their files and in the event similarity is found notify the sheriff's office.



EUGENE W. BISCALUIZ, *Sheriff*,
NORRIS G. STENSLAND, *Inspector*,
Bureau of Investigation.

PACKAGE LIBRARIES*

Compiled by and Available for Circulation
from the
LIBRARY BUREAU
of the
AMERICAN DENTAL ASSOCIATION
212 East Superior Street, Chicago, Ill.

†Abnormal secretion of saliva.
Absorption of roots and bone.
†Actinomycosis of head and neck.
Agranulocytic angina.
Alveolar process—its structure and resorption.
Alveolectomy.
Amalgam fillings and physical properties of amalgam.
†Anatomy of root canals.
Anesthesia—discovery and early uses.
†Anesthetics in children's dentistry.
Angle's orthodontic appliances.
Apicoectomy.
Articulation, occlusion and mandibular movements.
Avertin in oral surgery.
Bacteria of the mouth.
Bacteriological studies of root canals.
†Bell's palsy.
Best time for orthodontic treatment.
Biographies of dentists.
Blood examination in focal infection.
Bogue's articles from Dental Digest.
†Bridges using inlays as abutments.
Broken needles.
Bureau of Standards reports.
Business side of dentistry.
Calcium metabolism.
Cancer of mouth.
†Carbon dioxide administered in conjunction with nitrous oxid-oxygen anesthesia.
†Cast gold crowns.
Cast gold inlays.
Casting gold, including inlays and dentures.
Cavity preparation.
†Cementation of inlays.
Cements—uses and physical properties.
†Centric occlusion.
†Child psychology.
Children's dentistry.
Clasps—wire and cast.
Cleft lip and palate—etiology and surgical treatment.
†Cleft palate—orthodontic treatment and prosthetic appliances.
Community and school dental service.

*Each package library contains information on one of the subjects listed and is composed of reprints, magazine clippings, etc., on that subject only. The packages are loaned to members of the Association for a period of one week after date of receipt. Unless the material is reserved for another borrower, an extension of time will be granted on request.

The rental fee for borrowing a package library is 50 cents. This fee must accompany the request for a package library. No packages are sold.

†This package contains less than the usual number of articles.

Comparative dental anatomy.
Conduction anesthesia.
Condyle path movements.
†Congenitally missing teeth.
Contributions dentists have made outside their profession.
†Curetting.
Cysts and tumors of mouth.
Dental assistants.
Dental care of the preschool child.
Dental caries.
Dental clinics.
†Dental disease and practice in the tropics.
Dental economics.
Dental education.
Dental embryology.
Dental ethics.
Dental health education.
Dental hygienists.
Dental libraries.
Dental metallurgy.
†Dental nomenclature.
Dental service in the World War.
Dental technicians.
Dentifrices.
Dentistry as a career and the status of the dentist.
†Dentistry in foreign lands.
Dentistry of the time of George Washington.
Denture bases—discussion of materials.
Denture casting.
Diabetes and dentistry.
Diathermy in dentistry.
Diet and nutrition in relation to teeth.
Diet in pregnancy.
Diet in relation to periodontal disease.
Diseases of the tongue.
Dry socket.
Education of denture patients.
Electrodeposition of metals for dental purposes.
Electrogalvanic lesions.
†Emphysema.
Endocrine glands in relation to teeth.
†Epithelial débris.
Erosion and abrasion of the teeth.
†Eruption of teeth—dates of eruption and accompanying symptoms.
†Eruption of teeth—theories regarding.
Esthetics in denture construction.
Ethyl chlorid.
Ethylene anesthesia.
Etiology of caries.
Etiology of malocclusion and preventive orthodontia.
Evipal in oral surgery.
Evolution of human dentition.
Examination of the mouth and oral diagnosis.
Extraction of teeth.
†Facebow technic and recording of occlusion.
Facial prosthesis.
Fauchard's (Pierre) life.
Fixed and removable bridgework.
Fixed bridgework.

Focal infection.
†Focal infection and arthritis.
†Focal infection and oral sepsis in relation to gastro-intestinal disturbances.
Focal infection in relation to diseases of the eye.
Foreign bodies (of dental origin) in the lungs and esophagus.
Fractures of the jaws.
Full denture construction.
†Gagging.
Gold foil.
†Granulomas and granulomatous areas.
Growth and development of teeth and jaws.
†Growth of the mandible.
Habits as factors in malocclusion.
†Halitosis.
†Hawley's articles.
†Heat and cold therapy.
Hemophilia or excessive hemorrhage following extraction.
Hereditary influences in malocclusion.
†Histologic examinations of fractured roots.
Histologic study of teeth and tissues.
Histology of peridental membrane.
History and progress of dentistry.
History of dental ceramics.
History of dental education in U. S.
History of dentistry.
†History of full denture construction.
Hospital dental service.
†Hypercementosis and excementosis.
†Hypnotism.
Identification by means of teeth.
Immediate denture service.
Impacted teeth and their removal.
Impacted third molars.
Impacted teeth and their relation to various physical disturbances.
Impacted upper cuspids.
Implantation, replantation, transplantation of teeth.
Impression materials and technic.
†Impression taking for cast gold inlays.
Impression technic.
Incidence of dental defects.
Indirect inlay technic.
Industrial dental service.
Influence of deciduous teeth and first permanent molars on occlusion.
†Influence of dental improvements on appearance and mental conditions.
Influence of diet on saliva.
Innervation of teeth.
Interpretation of roentgenograms.
Investment compounds and technic.
Ionic medication.
†Jackson's (V. H.) articles on orthodontic appliances.
†Labial frenum.
Lectures to nurses.
Lesions of the mouth.
†Leukemia.
†Leukoplakia.
Local anesthesia.
Local anesthesia—contraindications and untoward results.
Lower denture construction.

†Ludwig's angina.
Malpractice in dentistry.
Masks and casts.
Materia medica and pharmacology.
†Matrix.
Maxillary sinus and antrum—diseases and treatment.
Methods of sectioning and staining teeth.
Monson's theory.
Mottled enamel.
Mouth hygiene.
Muscle exercises and training in orthodontia.
Nitrous oxid-oxygen analgesia.
Nitrous oxid-oxygen anesthesia.
†Nupercaine.
Occlusion in partial dentures.
†Occlusion in relation to operative dentistry.
Opening the bite.
Oral diagnosis with reference to roentgen ray.
Oral manifestations of metallic and drug poisoning.
Oral manifestations of systemic conditions.
Organized dentistry.
Orthodontia and its relation to dentistry and medicine.
Orthodontia for the general practitioner.
†Orthodontic anchor bands.
Orthodontic appliances.
Orthodontic diagnosis and measurements.
†Orthodontic treatment of impacted cuspids.
Osteomyelitis of the jaws.
"Panel" or insurance dentistry.
Partial dentures.
†Permeability of tooth structures.
Phonetics and speech defects.
Photography in dentistry.
Physical therapy in dentistry.
†Pinledge and pinlay attachments.
Place of extraction in orthodontic treatment.
Plastic surgery.
Pollia's articles on radiology.
Porcelain in dentistry.
Porcelain inlays.
Porcelain jacket crowns.
Postoperative complications and care.
†Postoperative psychosis.
Pregnancy and dental disease.
Preoperative examination of patients.
Preparation of cavities with hypersensitive dentin.
Preventive dentistry.
Preventive orthodontia.
Procain (novocain) dermatitis.
†Program building for state and district societies.
Prophylactic odontotomy.
Pulp amputation and mummification.
Pulp conservation including pulp capping and cavity lining.
†Pulp pathology.
†Pulp stones.
Pyorrhea.
Pyorrhea—early recognition and treatment.
Pyorrhea—etiology and relation to systemic conditions
Pyorrhea—surgical treatment of.

†Rebasing dentures.
†Receding gums.
Referred pain.
Relation between dental conditions and the mental health of insane.
Relation of the dentist to the physician.
Removable bridgework.
†Removable bridgework—discussing various types of attachments.
Research Commission reports.
Restoration of oral function including opening the bite.
Retainers used in orthodontia.
Retention of deciduous teeth and delayed eruption of permanent teeth.
†Retrusion of the mandible causing impaired hearing.
†Roofless dentures.
Root canal treatment.
†Root canal treatment in deciduous teeth.
†Salivary calculus.
†Salivary glands.
†Shock, syncope and collapse.
Should dentistry be advertised?
Silicate cements (see cements—uses and physical properties).
†Silver nitrate.
†Smith's articles on oral prophylaxis.
Social and economic phases of dentistry and other health services.
†Soldering.
†Space retention—its importance and methods of accomplishing.
Staining porcelain teeth.
Stainless steel and chrome alloys.
Stainless steel for orthodontic appliances.
Status of dentistry in our social and economic system.
Sterilization of dental instruments.
Stomatologic program (A.S.S.).
Stomatology—general discussions of.
Stories and rhymes for children.
Suggestions for talks to mothers.
Suggestions for talks to students.
†Supernumerary teeth.
Syphilis in relation to dentistry.
Temporomandibular joint.
Three-quarter crowns.
Tooth form and arrangement for full dentures.
Toothbrushes and toothbrushing technic.
Toothbrushes, tooth pastes and mouth washes.
†Torus palatinus.
Transplantation of teeth (see implantation of teeth).
Traumatic occlusion.
Trigeminal neuralgia.
Trismus and ankylosis.
Tuberculosis and dentistry.
Ultraviolet ray in the treatment of pyorrhea.
Ultraviolet ray therapy in dentistry.
Undergraduate and graduate orthodontic education.
Use of elevators in extraction.
Value of dental service in schools.
Value of roentgen-ray examinations in orthodontia.
Various studies of or pertaining to saliva.
Vincent's infection.
Vulcanite and vulcanite stomatitis.
Waxes and wax expansion method.
†Willett's articles.

OFFICERS AND TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION
1936-1937

PRESIDENT

Leroy M. S. Miner.....363 Marlborough St., Boston, Mass.

PRESIDENT ELECT

C. Willard Camalier.....1726 Eye St., N.W., Washington, D. C.

VICE PRESIDENTS

Raoul H. Blanquie.....Flood Bldg., San Francisco, Calif.
James V. Gentilly.....Rose Bldg., Cleveland, Ohio
James A. Blue.....Comer Bldg., Birmingham, Ala.

SECRETARY

Harry B. Pinney.....212 E. Superior St., Chicago, Ill.

TREASURER

R. H. Volland.....First Capital Nat'l Bank Bldg., Iowa City, Iowa

BOARD OF TRUSTEES

Leroy M. S. Miner, President, Ex-Officio....363 Marlborough St., Boston, Mass.
C. Willard Camalier, President-Elect, Ex-Officio.....1726 Eye St., N.W., Washington, D. C.
Harry B. Pinney, Secretary, Ex-Officio.....212 E. Superior St., Chicago, Ill.
R. H. Volland, Treasurer, Ex-Officio.....First Capital Nat'l Bank Bldg., Iowa City, Iowa
Harvey J. Burkhart, '39.....Box 879, East Avenue P. O., Rochester, N. Y.
C. R. Lawrence, '39.....730 Bass Bldg., Enid, Okla.
Herbert C. Miller, '39.....E. 6th and Oregon Sts., Portland, Ore.
Wilfred H. Robinson, '39.....1706 Broadway, Oakland, Calif.
J. Ben Robinson, '38.....Medical Arts Bldg., Baltimore, Md.
Thomas L. Grisamore, '38.....29 E. Madison St., Chicago, Ill.
E. G. Meisel, '38.....121 University Place, Pittsburgh, Pa.
C. J. Caraballo, '38.....Stovall Bldg., Tampa, Fla.
George E. Morgan, '38.....2039 North Prospect Ave., Milwaukee, Wis.
J. G. Hildebrand, '37.....Waterloo, Iowa
Albert R. Ross, '37.....Murdock Bldg., Lafayette, Ind.
Oren A. Oliver, '37.....Medical Arts Bldg., Nashville, Tenn.
Philip E. Adams, '37.....106 Marlborough St., Boston, Mass.